TECHNICAL REPORT 4429

APPROVED SAFETY CONCEPTS FOR USE IN MODERNIZATION OF USAMUCOM INSTALLATIONS

SAFETY ENGINEERING IN SUPPORT OF AMMUNITION PLANTS

BY

NORVAL DOBBS – AMMANN & WHITNEY

ROBERT PARKER (COORDINATOR) - PICATINNY ARSENAL

RAYMOND HENDERSHOT (COORDINATOR) - U. S. MUNITIONS COMMAND

OCTOBER 1972

MANUFACTURING TECHNOLOGY DIRECTORATE

PICATINNY ARSENAL

DOVER, NEW JERSEY

The findings in this report are not to be construed as a regulatory document by the Department of the Army, unless so designated by other authorized documents.

Destroy this report when no longer needed. Do not return to the originator.

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
Picatinny Arsenal
Dover, New Jersey 07801

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP

3. REPORT TITLE
Approved Safety Concepts
For Use in
Modernization of USAMUCOM Installations

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

5. AUTHOR(S) (First name, middle initial, last name)
Norval Dobbs - Ammann & Whitney
Robert Parker - Picatinny Arsenal (Coordinator)
Raymond Hendershot - U.S. Army Munitions Command (Coordinator)

6. REPORT DATE
October 1972

7a. TOTAL NO. OF PAGES

7b. NO. OF REFS

8a. CONTRACT OR GRANT NO.
DAAA-21-72-C-0176

b. PROJECT NO.

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
Technical Report

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT
[redacted]

11. SUPPLEMENTARY NOTES
Report completed in
collaboration with
Ammann & Whitney, New York, N.Y.

12. SPONSORING MILITARY ACTIVITY
U.S. Army Munitions Command
Dover, New Jersey 07801

13. ABSTRACT

This report provides approved safety concepts for use in facility siting and structure layouts developed in connection with USAMUCOM modernized installations and activities. These concepts have been reviewed by both the U.S. Army Materiel Command and the Department of Defense Explosives Safety Board and approved for use in new construction design by USAMC-SF.

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

UNCLASSIFIED

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
1. Approved Safety Concepts 2. AMCR 385-100 and TM5-1300 3. Effective Barricades 4. Explosive Collection Facilities 5. Safe Separation of Explosives 6. Load-Assembly-Packout Facilities						

TECHNICAL REPORT

APPROVED SAFETY CONCEPTS FOR USE IN MODERNIZATION OF USAMUCOM INSTALLATIONS

SAFETY ENGINEERING IN SUPPORT OF AMMUNITION PLANTS

By

Norval Dobbs - Ammann & Whitney

Robert Parker (Coordinator) - Picatinny Arsenal
Raymond Hendershot (Coordinator) - U.S. Munitions Command

October 1972

Manufacturing Technology Directorate
Picatinny Arsenal
Dover, New Jersey

PREFACE

The purpose of this report is to provide safety concepts that can be used in facility siting and structure layouts developed in connections with the USAMUCOM modernization program for installations and activities. This is not a regulatory document.

Although each concept is a single entity within itself, at any time it may be modified and/or supplemented. Therefore, any reference to a given concept shall be accompanied with a date indicating the latest issue.

The enclosed safety concepts have been developed by Picatinny Arsenal as a part of their overall engineering program entitled "Safety Engineering in Support of Ammunition Plants" for the U.S. Army Munitions Command, with assistance from Ammann & Whitney, Consulting Engineers, New York.

ACKNOWLEDGEMENTS

The author wishes to express his sincere appreciation to the following for the valuable assistance and comments during the development of the concepts, and for their review after the completion of the concepts: Mr. C.A. Breeding (DODESB); Messrs. W.G. Queen, A. Wall and M. Zaug (USAMC-SF); Mr. E.M. Van Pattan (AMSMU-SF); Messrs. L. Saffian, I. Forsten, S. Wachtell and R. Rindner (SMUPA-MT); and Messrs. E. Cohen, M. Dede, J. Porcaro and K. Gandhi (Ammann & Whitney).

TABLE OF CONTENTS

INTRODUCTION

Purpose

The purpose of this report is to provide approved safety concepts for use in facility siting and structure layouts developed in connection with USAMUCOM modernized installations and activities.

Scope

These safety concepts apply to all USAMUCOM installations and activities and have been approved by both the U.S. Army Materiel Command and the Department of Defense Explosives Safety Board.

Each concept is a single entity within itself but may, at any time, be modified and/or supplemented. Therefore, any reference to a given concept shall be accompanied with a date indicating the latest revision.

Objective

To establish necessary clarification or modification of and addition to AMCR 385-100 for use during concept formulations, engineering development and final design of USAMUCOM installations and activities including new facilities, renovation, rework, demilitarization and disposal.

Background

U.S. Army Munition Command (USAMUCOM) is presently participating in an Army-wide modernization program of explosive manufacturing facilities under its command. This program is primarily directed towards a more efficient and safer production of explosive munitions.

Regarding the safety aspects, submission of safety criteria by several USAMUCOM facilities has shown a wide variation in modernized safety concepts when applied to a similar type of explosive facilities. Therefore, at the request of USAMUCOM, Picatinny Arsenal, with the assistance of Ammann & Whitney, has undertaken a study to develop "approved safety concepts" to achieve uniformity of safety criteria application.

Although the concepts as presented are not of a regulatory nature, their application will facilitate safety reviews and approvals, and in some cases, are to be considered by cognizant safety personnel as modifications and/or supplements to the safety requirements of AMCR 385-100.

REVISION NO. 1
(December 1972)

ITEM - 5

a. Page 5-2; Add the following sentence to Paragraph 1:

"Separation of the Inspection Building from the Unpacking Building shall conform to intraline distance based upon the larger of the two quantities of explosive in the two buildings."

b. Page 5-2; Replace Paragraph 2 with the following:

"Personnel may be permitted to enter any given area within either the Receiving or the Unpacking Building at any given time. If the tote bins are used for packaging of bulk explosives, personnel may be permitted to enter the Inspection Bays in the Inspection Building to replace empty bins with full bins. All other operations in the Inspection Bays must be performed remotely. Cardboard boxes used for shipping bulk explosives may be opened in the Receiving Building; however, movement of the boxes inside the Inspection Bays, the opening of the plastic liners of the cardboard boxes, and dumping of the explosives into the inspection equipment shall be performed remotely. The plastic liners may be opened manually in the Unpacking Building or in the Inspection Building in separate bays set aside specifically for that purpose. Movement of the boxes inside the Inspection Bays and subsequent operations shall be accomplished remotely. If desired, the bulk explosive may be placed in tote bins within the Unpacking Building for movement to the Inspection Building and thereby permitting the personnel conveying the tote bins to enter the Inspection Bays."

c. Plate No. 1.11; Replace Plate No. 1.11 dated October 16, 1972 by Plate No. 1.11 First Revision dated December 1972.

d. Plate No. 5.1; Replace Plate No. 5.1 dated October 16, 1972 by Plate No. 5.1 First Revision dated December 1972.

e. Plate No. 5.3; Replace Plate No. 5.3 dated October 16, 1972 by Plate No. 5.3 First Revision dated December 1972.

ITEM - 1

EFFECTIVE BARRICADING OF BUILDINGS

1. Means of Barricading - New Construction or Major Modification

In order that two adjoining buildings be separated by barricaded intraline distance, the buildings must be provided with an effective barricade or a combination of effective barricades. Three means are available for providing barricading: namely, (1) effective dividing walls, (2) effective earth barricades, and (3) structure burial.

2. Effective Dividing Walls

a. Type of Dividing Walls

For dividing walls to be effective, they shall be constructed by utilizing reinforced concrete and/or structural steel. Each wall shall be designed to resist, with response limited to incipient failure deflection (TM5-1300), the blast effects of a detonation within the building it is protecting as well as the blast and fragments (both primary and secondary fragments) produced by an explosion in the adjoining building.

b. Positioning of Dividing Walls

For a dividing wall or a combination of dividing walls to be considered effective, one of the following wall arrangements shall be utilized:

(1). Dividing Wall Arrangement No. 1 (Plate No. 1.1)

Two buildings containing approximately the same explosive quantity shall be separated by barricaded intraline distances based upon the larger of the two explosive quantities. The wall of each building facing the adjoining building shall be designed as an effective dividing wall. The height of each wall shall be at least 3 feet above the height of its respective building or as defined by Line of Sight No. 2 illustrated in Plate No. 1.1.

(2). Dividing Wall Arrangement No. 2 (Plate No. 1.2)

When the explosive quantity in one building (Building "A") is substantially larger than the explosive quantity in an adjoining building (Building "B"), then the two buildings shall be separated by a barricaded intraline distance based upon the larger of the two explosive quantities. The wall of Building "B" facing Building "A"

shall be designed as an effective dividing wall while the wall of Building "A" facing Building "B" may be designed for conventional loadings (non-blast resistant). The height of the dividing wall shall be similar to that defined for Arrangement No. 1 and as illustrated in Plate No. 1.2. For this arrangement to be applicable, the unbarricaded intraline distance based upon the smaller explosive quantity must be equal to or less than the barricaded distance mentioned above.

Attention is directed to the notes of Plate No. 1.2 for applicability of this dividing wall arrangement.

(3). Dividing Wall Arrangement No. 3 (Plate No. 1.3)

A building containing explosives (Building "A") shall be separated from a building containing inert materials (Building "B") by a barricaded intraline distance when the wall of the inert material building facing the building with explosives is designed as an effective dividing wall.

The wall of the building containing explosives which faces the inert material building may be designed for conventional loadings (non-blast resistant). The height of the dividing wall shall be similar to that described for Arrangements Nos. 1 and 2 and as illustrated in Plate No. 1.3.

(4). Multi-Bay Effects (Plates Nos. 1.4 and 1.5)

In the event that either (or both) of the two adjoining buildings are subdivided into multi-explosive bays to prevent propagation of explosion within the building(s), the separation between the two buildings shall be based upon the quantity of explosive corresponding to the largest quantity-separation distance. For example, the 5,000 pounds of explosive located in Bay 2 (Plate No. 1.4) will require a barricaded intraline separation of 150 feet which, in combination with the width of Bay 3 (20 feet), will result in a building separation of 130 feet. This distance is larger than the intraline distance required of the quantity of explosive required in Bay 1, Bay 3 or Building "B". A second example of multi-bay building quantity-distance requirements is illustrated in Plate No. 1.5. Here, the inert material building (Building "B") is separated from the multi-bay building (Building "A") by a barricaded intraline distance based upon the quantity of explosive in Bay 1 which, in combination with the width of Bay 2, will result in a separation between buildings of 130 feet. It may be noted that, in the latter example, the blast pressures acting on the ground immediately in front of the inert building produced by an explosion in Bays 1 and 2 will be 12.5 and 10.5 psi, respectively, both of which are large enough to produce significant damage to the structure's roof and side walls.

3. Effective Earth Barricades

a. Type of Earth Barricades (Plate No. 1.6)

All new construction of earth barricades shall utilize the single revetted concept. Existing double revetted and earth-mound barricades shall be replaced during new construction, major modifications, or as they need replacement. Earth-mound barricades may be altered to form single revetted barricades, if desired. A possible means for accomplishing this alteration is illustrated in Plate No. 1.6.

b. Positioning of Barricades

Each new and modified barricade shall be separated from the building it is protecting (receiver structure) by a distance equal to or less than one quarter the building height.

For a barricade or a combination of barricades to be considered effective, one of the following barricade arrangements shall be utilized:

(1). Barricade Arrangement No. 1 (Plate No. 1.7)

Two buildings containing approximately the same quantity of explosives shall be separated by a barricaded intraline distance based upon the larger quantity when the wall of each building which faces the adjoining building is protected by a barricade. Each barricade shall extend above the building it is protecting by at least 3 feet or as defined by Line of Sight No. 2 illustrated in Plate No. 1.7. Also, the length of each barricade shall be long enough to extend 3 feet beyond the two lines connecting the common sides of the two buildings (Plate No. 1.7).

(2). Barricade Arrangement No. 2 (Plate No. 1.8)

When the quantity of explosive in one building (Building "A") is substantially larger than the explosive quantity in an adjoining building (Building "B"), the two buildings shall be separated by a barricaded interline distance based upon the larger quantity of explosive if a barricade is positioned at the building having the smaller amount of explosive (Building "B"). The height and length of the barricade are similar to those described from Arrangement No. 1 or as illustrated in Plate No. 1.8. For this arrangement to be applicable, the unbarricaded intraline distance based upon the smaller explosive quantity must be equal to or less than the barricaded distance mentioned above.

(3). Barricade Arrangement No. 3 (Plate No. 1.9)

A building containing explosives (Building "A") shall be separated from a building containing inert material (Building "B") by a barricaded intraline distance when a barricade is positioned at the building containing the inert material. A barricade is not required at the explosive building. The height and length of the barricade are similar to those described for Arrangements Nos. 1 and 2.

4. T-Barricades (Plate No. 1.10)

a. Use of T-Barricades

T-Barricades shall only be used in the bulk receiving and/or shipping portions of a facility for separation of explosive quantities not to exceed 50,000 pounds. The separation distance between the explosives at opposite sides of the barricade shall be equal to 1.1 times the cube root of the larger of the two explosive quantities.

b. Barricade Configuration

The base of a T-Barricade shall be at least 19 feet wide. Each side of the barricade shall have a slope of 5 on 2 for a barricade height up to 20 feet. For barricades higher than 20 feet, the width at the top of the barricade shall be equal to 3 feet. The top of the barricade shall extend at least 6 feet above the top of the highest stack of explosive and/or shall meet the requirements for the line of sight illustrated in Plate 1.10.

5. Fully and Partially Below-Grade Structures

a. Effective Barricading (Plate No. 1.11)

Buildings positioned fully or partially below grade may be separated from adjoining below and/or above-ground buildings by barricaded intraline distances when all of the explosive within the below grade structure is located (1) below the ground surface, (2) below the top of the mound of a partly buried, partly earth-mounded structure, or (3) when the above-ground portion of the explosive in a partly above and partly below ground building is protected by TM5-1300 walls. For a fully or partially below grade structure to be fully effective as a barricade, the explosive must be positioned below the top of the building based upon the line of sight formed between the tops of the below grade structure and the adjoining above-ground structure. This line of sight is illustrated in Plate No. 1.11.

Use of fully or partially below-grade structures is approved for those situations where neither people nor expensive (long lead) equipment is located in the unprotected above-ground portion of the structure.

b. Below Grade Structure Arrangements (Plate No. 1.12)

(1). Structure Arrangement No. 1

Arrangement No. 1 may be utilized when all explosives within the building are positioned below the grade. In most situations this arrangement is used when the above-ground portion of the structure is expendable and therefore is permitted to collapse as a result of an explosion within the structure or in the adjoining structures. Personnel and/or valuable equipment may not be positioned in the expendable portion of the structure. In some cases, however, it may be desirable to design the above-ground portion of the structure to resist the effects of a detonation in an adjoining building. In this latter case, the above-ground portion in addition to being designed to resist external loads, shall also be capable of releasing the blast loads produced by an explosion within the building. An illustration of this below-grade structure arrangement is shown on Plate No. 1.12.

An alternative structure arrangement to Below-Grade Structure Arrangement No. 1 is also shown in Plate 1.12. Here, rather than being situated above ground, the frangible roof is positioned flush with the ground.

At the present time, only a minimal amount of data relating to the blast-resistant capacity of buried buildings is available. However, tests are presently being developed whereby the necessary design data will be obtained. In the interim, it is recommended that the walls of Below-Grade Structure Arrangement No. 1 be designed to resist the conventional earth and surcharge (live and dead) loads. Therefore, reinforced concrete walls will not require the use of laced reinforcement.

(2). Structure Arrangement No. 2

Below-Grade Structure Arrangement No. 2 may be utilized when a portion of the explosive within a building is located above the ground and the remainder below the ground. In this arrangement, the above-ground part of the building is protected by an earth barricade. For this arrangement, it is recommended that laced reinforcement be used in concrete walls which extend above the ground surface more than 10 feet. The lacing shall extend below the ground to a sufficient depth in order to insure full development of the flexural reinforcement. Concrete walls whose height above the

ground is less than 10 feet may be designed similarly to the walls of the below-ground portion of the building as indicated for Arrangement No. 1.

(3). Structure Arrangement No. 3 (Plate No. 1.12)

Below-Grade Structure Arrangement No. 3 is similar to Arrangement No. 2 except that the explosive positioned above the ground is protected by laced reinforced concrete walls rather than by earth barricades. The above-ground portion of the walls shall be constructed of laced reinforced concrete.

ITEM - 2

EXPLOSIVE COLLECTION FACILITIES FOR USE IN NEW CONSTRUCTION

1. Collector Facilities

Explosive collection facilities include vacuum collectors (wet, dry, portable or stationary), vacuum collector buildings, and pollution abatement processing facilities.

2. Vacuum Collectors in Operating Buildings (Plate No. 2.1)

The portable wet and dry collectors shall be located within the operating building in accordance with the requirements of Section 27-7c of AMCR 385-100. However, a maximum accumulation of the explosive within any one collector or series of collectors in anyone bay shall not exceed 5 pounds of H.E.

A collector shall service only one operating bay. When the collector is positioned in a separate bay, the collector bay should be located as close as possible to the operating bay which it serves. The collector bay shall consist of protective walls enclosing the collector on three sides. The walls shall extend two feet past the exterior surface (walls and roof) of the operating building. If a blast resistant roof is provided, then the walls of the collector bay need not extend above the building roof. The walls and roof of a collector bay shall be designed for a response limited to the incipient failure deflection. A bay which houses a collector shall not be used for other operations or as a communicating corridor or passageway. Lines carrying explosive waste from an operating bay to a collector bay shall be provided with detonation traps or other positive means to prevent a propagation of explosion between the bays. A wet portable collector which is positioned in an operating bay may service that bay only and, therefore, requires no special shielding.

3. Vacuum Collectors Exterior of Operating Building

a. Explosive Quantity Distance Requirements (Plates Nos. 2.2 and 2.3)

Each wet or dry collector containing more than 5 pounds of H.E. shall be positioned in a separate building which shall be separated from the operating building it is serving by a distance conforming to the barricaded intraline distance based upon the quantity of explosive in the collector building. Separation between the collector building and an adjoining operating building, not serviced by the collector building, shall conform to intraline distance based upon the quantity of explosive in the operating building (Plate No. 2.2).

If two or more collector buildings adjoin one another, their separation shall conform to intraline distance based upon the largest quantity of explosive in the collector buildings. However, the separation between any one of the collector buildings and the operating buildings it is not serving, shall conform to intraline distances based on the explosive quantities in the operating buildings (Plate No. 2.3).

b. Collector Building (Plate No. 2.4)

A vacuum collector building shall service only one operating building. Where possible each room or bay of the operating building shall be serviced by a separate collector in the collector building. However, a single collector in a collector building may be used to service no more than two operating bays when separate exhaust lines are provided for each operating bay. If desired, the two exhaust lines may be serviced by a common header leading to the vacuum collector building. No more than two primary collectors located either in the operating or collector buildings shall be serviced by a secondary collector (wet or dry) located in the collector building.

Each collector (primary or secondary) shall be separated from the adjoining collectors and the building it is serving by dividing walls. The walls shall be designed to resist the effects of an explosion in the collector building with a response limited to incipient failure deflections.

Vacuum lines between the operating and the collector buildings shall be provided with detonation traps or other positive means for preventing a propagation of explosion between the buildings.

4. Pollution Abatement Processing Facilities (Plate No. 2.4)

A centrally located Pollution Abatement Processing Facility may be used to serve more than one vacuum collector building and more than one operating building at the same time. However, an abatement facility shall be separated from all operation and collector buildings by intraline distances. All lines serving the facility that carry explosive waste shall be provided with detonation traps or other positive means to prevent a propagation of explosion between the buildings and/or operations.

ITEM - 3

TRANSFER OF EXPLOSIVES THROUGH BUILDINGS

1. General

The methods used for transferring explosives through operating buildings will be dependent upon several factors including (1) the building subdivision, (2) operational hazards and (3) the methods used for conveying the explosives.

The subdivision of a building will be a function of operational considerations as well as explosive quantity/separation distance requirements. On the other hand, operational hazards which are specified in USAMUCOM Regulation 385-22, must be established from a hazard analysis of the specific facility operation. The third factor affecting the transfer of explosives through the buildings will be a function of the first two factors and, as will be shown later, is interrelated to the selection of method used for inter-bay transfer of explosives.

2. Subdivision of Buildings

The subdivision of buildings for operational and/or quantity-distance requirements may be achieved with the use of blast resistant barriers (dividing walls) as specified by AMCR 385-100.

All dividing walls shall be designed in accordance with TM5-1300 with the structure's response based on the protection category (TM5-1300) requirements specified in the design criteria for the operations of the receiver bays. In addition, each dividing wall shall be designed to prevent overturning due to blast effects of an explosion. In most cases, this will require a structural monolithic interaction between a wall and the adjoining floor and roof (if blast resistant) slabs of the building.

The explosive limit for each bay will be based on the total quantity of explosives in all items not properly spaced or barricaded to prevent propagation from item to item, regardless of the hazard category involved.

3. Hazard Considerations (Plate 3.1)

Depending upon the hazard of the operation in a given operating bay, certain safety provisions must be adhered to for transferring the explosive items through an operating building. These provisions are as follows:

a. Hazard Category I

No special provisions for safe spacing and/or shielding of items are required for operating bays containing only Hazard Category I operations provided each bay is separated from the adjoining bays by protective barriers (TM5-1300). Blast resistant barriers between adjoining bays shall be designed to prevent a direct line of sight between the adjoining operating areas. The line of sight concept will be discussed later.

Safety provisions for Category I hazards are illustrated in Plate No. 3.1.

b. Hazard Category II

In addition to requiring that blast resistant barriers be furnished to prevent a direct line of sight between adjoining bays, the operating bays containing the Hazard Category II operations will require that individual items or cluster of items be separated by safe spacing and/or be provided with shielding to negate explosion propagation between adjacent items.

Some data are available in Table 17.1 of AMCR 385-100 and from the results of recent tests conducted under the direction of Picatinny Arsenal regarding safe separation of ammunition on conveyors. However, in most cases, tests will be required to demonstrate the effectiveness of the item separations and/or shielding to be used for a given facility design.

Safety provisions for Category II hazards are shown in Plate No. 3.1.

c. Hazard Category III (Plates Nos. 3.1 and 3.2)

Items passing through areas containing Hazard Category III operations shall be provided with special shielding to provide a full protection for personnel and equipment exterior of the shield. The protective shield may be located in a separate operating bay or in a bay containing other operations.

A Hazard Category III operating shield may be constructed either of reinforced concrete and/or structural steel. The shield must be designed such that all fragments produced by the break-up of an item casing and/or equipment are fully contained. Blast pressures produced by the internal explosion shall be vented to the atmosphere through a venting stack no larger than 15 inches in diameter and extend at least 15 feet above the highest point on the operating building roof or 15 feet beyond the exterior walls. The exterior surface of the operating building shall be designed to resist the

leakage overpressures from the venting stack of at least 1.2 psi (strengthened frangible construction).

Access within the shield of explosives, personnel and equipment shall be through a series of blast doors which shall be closed and sealed against rebound during the performance of the hazardous operation. All operations performed within the shield shall be accomplished remotely.

The above shield is adequate for explosive quantities up to 15 pounds. Therefore, the performance of Hazard Category III operation with explosive quantities greater than 15 pounds shall be accomplished in a separate operating building. Hazard Category III operations in a shield or in a separate building shall be performed remotely.

A schematic representation of a Hazard Category III operating shield is illustrated in Plate No. 3.2.

4. Inter-Bay Item Transfer

When an operating building is subdivided by dividing walls for quantity-distance and/or operational purposes, the movement of items from one operating bay to another will require the transfer of the items over, around and/or through the protective barriers. To be assured that propagation of explosion between adjoining operating bays will be negated, all openings in the dividing wall shall be arranged such that a direct line of sight through the openings will be interrupted. Also, in the case of transferring items around and/or over the walls, sufficient safe spacing and/or shielding shall be provided to insure that in the event of mass detonation in one bay, propagation of explosion does not occur in the adjoining receiver bays. In most facility designs, any one operating bay must be considered both as a donor and a receiver bay.

a. Item Transfer Through Dividing Walls

Methods are available for accomplishing the interruption of a direct line of sight through the openings in the walls and still be capable of transferring explosive items from one operating bay to another with the use of conventional material handling equipment. Several of these methods are described below.

(1). Maze Concept (Plates Nos. 3.3 and 3.4)

The passage of items through the maze is so controlled that items at one side of the wall will always be shielded from items at the opposite side. This control may be illustrated with the use of Plate No. 3.3 and as described below.

Stage No. 1 indicates a typical operation where Lot No. 1 has passed through the maze into Bay 2, Lot No. 2 is positioned in the safe zone of the maze, and Lot No. 3 is approaching the hold station in Bay 1 before entering the maze. It may be noted that all three lots of items are protected from one another in the event an explosion occurs in any one of the three lots.

Stage No. 2 illustrates the situation where Lot No. 1 has passed further into Bay 2 and with Lot No. 2 just entering Bay 2 while Lot No. 3 is still at the hold station (Point "A") of Bay 1. At this stage, Lot No. 2 is considered to be a part of the explosive quantity in Bay 2 and if an explosion occurred in Bay 2, this lot could detonate without propagating to Lot No. 3.

Stage No. 3 illustrates Lot No. 2 has completely passed into Bay 2 and thereby permits Lot No. 3 to move towards the safe zone of the maze. At no time during this stage of movement can Lot No. 3 propagate to Lot No. 2. Although not shown in this illustration, once Lot No. 3 reaches the safe zone within the maze, a new lot of items can be accumulated at the hold station (Point "A") in Bay 1.

Construction of a maze shall be the same as that of the dividing walls. All elements of a maze shall be designed to sustain damage equal to or less than that of the dividing wall. Sufficient clearance within the maze shall be provided to insure that the separation distance between the item and the elements of the maze meet the requirements of Paragraph 4-9 (TM5-1300). Furthermore, sufficient clearance shall be provided for maintenance purposes. A maze may be provided with or without a roof. For the latter, the walls of the maze shall be high enough so that a line drawn from the top edge of the item to the top edge of the wall will form a 30-degree angle or less with the vertical.

Configuration requirements for mazes are illustrated in Plate No. 3.4.

In general, the speed of the conveyor transferring the items through a maze will be equal to the maximum conveyor speed in other parts of a facility. Therefore, for facilities with high production rates, conveyor speeds may be as high as 50 or 60 fps which, in turn, may require the use of large mazes to achieve the necessary turn radius of the conveyors.

Plate 3.1 illustrates the transfer of explosive items through mazes. Here, the path of the conveyor movement is along the center of the operating bays and, therefore, through the middle of the dividing walls. It may be noted that a maze is provided for passage of items between Bays 1 and 2 even though the operations performed in each bay are considered to be in Hazard Category I (exclusive of operation in the shield).

(2). Turntable Concept (Plate No. 3.5)

The turntable concept is an extension of a method used in the past for transferring items from one hazardous area to another. In this method, explosive items pass through a revolving mechanism. The mechanism is divided into compartments such that a shield will separate adjoining items as they pass through the wall opening.

Turntables can be located at the ends of walls and/or within walls. In all cases, the speed of the turntable has to be synchronized with the speed of the conveyor. In general, turntables will only have to revolve at several revolutions per minute in order to maintain conveyor speeds upwards to 60 feet per minute.

Turntables may be constructed of structural steel, aluminum or other structural metals. The partitions of the turntables which serve as shields must be capable of preventing propagation of explosion between adjoining items. In most cases, tests will be required to establish a safe thickness of the partition shields. The turntable as a whole must be capable of resisting the blast and fragment effects of a mass detonation in either of the adjoining bays, at response levels equal to or higher than that of the wall.

Schematics of the turntable concept are illustrated in Plate No. 3.5.

Plate No. 3.6 illustrates the passage of explosive items through turntables. Here, the passage of the items is from the entrance corridor of the building and through a turntable into operating Bay 1 while other items proceed along the corridor and into Bays 2 and 3. After completing the operation in each bay, the items pass through a second set of turntables leading to the exit corridor and then out of the building. The use of the turntable permits the passage of items through the corridor in front of operating bays without endangering the explosive within the bays from an explosion in the corridor or adjoining bays, or without endangering the explosive in the corridor due to an explosion in one of the bays.

(3). Blast Lock Concept (Plate No. 3.7)

The blast lock concept utilizes a double blast door arrangement to prevent a direct line of sight. Here, one of the two doors is closed at all times and, thereby, averting a propagation.

Both blast doors may be constructed of structural steel. They shall be designed to resist the blast and fragmentation effects of a mass detonation in either adjoining bay. Because high speed fragments are usually associated with an explosion, the use of built-up doors (using thin steel skin attached to structural members)

is not advisable. A conceptual layout of a blast lock is illustrated on Plate No. 3.7.

b. Item Transfer Over and Around Dividing Walls (Plate No. 3.8)

Because of the methods for transferring explosive items over and around the dividing walls are similar, the following discussion of the item transfer is applicable to both directions of the wall traversal.

As previously mentioned, for items passing through the walls, an interruption of the line of sight between the operating bays must be achieved to insure that a propagation of explosion from one bay to another will not occur. The line of sight requirement also applies to items moving around the walls and can only be achieved with the use of a safe spacing and/or shielding between the items. In the event of an explosion occurring in an operating bay, the items moving around the wall from the donor bay to the receiver bay shall be so spaced or shielded from the items in the receiver bay that a propagation will not take place. This general principle is illustrated in the following examples.

Plate No. 3.8 is a schematic diagram of a three-bay operating building subdivided by dividing walls. The explosive operations are performed at the centers of the bays and the item transfer from one bay to the other is accomplished by movement around the dividing walls. In the event of a mass detonation in Bay 2, an item in Bay 1 which is exposed to a detonation is separated from the highly congested operating area (Hazard Category I operation) at the center of Bay 1 by a safe separation distance and/or shielding as indicated by Note 1 (Plate No. 3.8). In the case of safe spacing, the required separation would have to be established by testing. On the other hand, shielding of an item traversing around the wall could be accomplished with the use of a turntable (Plate No. 3.5) located at the end of the wall. Protection from an explosion propagation to Bay 2 from a mass explosion in Bay 1 is achieved by maintaining a safe spacing and/or shielding between the individual items or lots of items as required for Hazard Category II operations when they move around the end of the walls. This protective procedure can be used because of the safe spacing requirements for the items in Bay 2 predicated by the Hazard Category II operation being performed in this bay. Prevention of a propagation between Bays 2 and 3 is accomplished in the same manner as that described for Bay 2 from an explosion in Bay 1.

Another example of item transfer around walls is shown on Plate No. 3.9. In this illustration the items enter each operating bay from a common entrance corridor. After the individual operations are completed the items exit from each bay by means of a common exit corridor. The building arrangement requires explosive items in the

corridors to pass in front of the open ends of the operating bays. In the event of a mass explosion in Bay 1, all corridor items in the indicated distance labeled "Note 1" (Plate No. 3.9) shall be considered as part of the explosive quantity of Bay 1 for establishing quantity-distance separation between this and adjoining buildings. To prevent continued propagation of explosion along the corridor, safe spacing and/or shielding between items in front of adjoining bays must be maintained (Note 2, Plate No. 3.9). In addition to preventing a continued explosion propagation along the corridor, the required corridor item spacing (or shielding) will also prevent a propagation of explosion between adjoining bays. The spacing and/or shielding of the corridor items will require testing which, in turn, must consider the effects produced by mass detonation within the bay. In addition, it is desired not to produce propagation into an operating bay due to an explosion in the corridor, and therefore, the flow of the items into a bay must be controlled in order to assure that a safe spacing between the bay and corridor items is maintained. Shielding may also be used to achieve the latter protection.

ITEM - 4

TRANSFER OF EXPLOSIVES BETWEEN BUILDINGS

1. General

Transfer of explosives can be accomplished with the use of conveyor systems, pneumatic systems and/or hydraulic systems. Both the pneumatic and the hydraulic systems will require the use of detonation traps and/or other positive means to prevent propagation of explosion from one building to another through the lines. On the other hand, prevention of explosion propagation along conveyors may be achieved by providing safe spacing and/or shielding between items. This required safety data must be obtained from tests. In some cases, however, it may be more advantageous not to negate explosion propagation in ramps (between buildings) but to limit explosion propagation from extending into the adjoining buildings. This procedure is discussed further below.

Because a more detailed discussion of the prevention of propagation through the pneumatic and the hydraulic systems is given in Item 5 of this report, the remainder of the description for transferring explosives between buildings will be devoted to items on conveyors.

2. Conveying of Explosives

Three arrangements have been developed by which explosives may be transferred between the adjoining buildings without producing a propagation of explosion.

a. Arrangement No. 1 (Plate No. 4.1)

In Arrangement No. 1, individual items and/or lots of items are allowed to accumulate in the ramp between the buildings. In the event of a detonation in the ramp, propagation of explosion will extend throughout the entire length of the ramp. However, to prevent extension of the explosion into the buildings, effective dividing walls are located at the points where the ramps enter the building. Each of these walls is designed to withstand the effects of a mass detonation in the ramp or within the building it is protecting. Other than the two buildings connected by the ramp, all adjoining buildings must be separated from the ramp based upon the larger of the quantities of explosive in the ramp or in each adjoining building.

The conveying arrangement described above is primarily applicable for a conveyor having a straight run between buildings. The

introduction of turns will, in turn, reduce the effectiveness of this arrangement and in some cases completely eliminate its effectiveness altogether.

b. Arrangement No. 2 (Plate No. 4.2)

In Arrangement No. 2 all of the individual items or lots of items are separated from one another by safe spacing and/or shielding, thereby preventing the occurrence of a mass detonation within the ramp. The limiting of the explosion propagation will negate the need for dividing walls at each end of the ramp. However, in determining the safe separation requirements, consideration must be given to the safe spacing required to prevent propagation to the ramp produced by a mass detonation within either of the buildings.

c. Arrangement No. 3 (Plate No. 4.3)

Arrangement No. 3 is a combination of Arrangements Nos. 1 and 2. Here, the individual items (or lots of items) in the ramp are separated by required safe spacing and/or shielding. The effective dividing walls positioned at the ends of the ramp protect the buildings from a detonation in the ramp as well as the explosives in the ramp from an explosion in the building. The use of this system will eliminate the need for establishing a safe separation for the item in the ramp due to a mass explosion in one of the buildings.

ITEM - 5

SPECIAL SAFETY CONCEPTS FOR LAP INSTALLATIONS

1. Suggested Explosive Limits for LAP Installations

Except as noted in other items of the report or as specified by USAMUCOM and AMC Safety Regulations, the following explosive limits for individual components of Load-Assembly-Packout (LAP) installations are recommended. However, depending upon a given facility layout and the explosive hazards involved, explosive limits excessively higher than those recommended will require a special safety review.

RECOMMENDED EXPLOSIVE LIMITS

Bulk Explosive Receiving Magazine	-	225,000 lbs.
Inspection and/or Screening Building (per Bay)	-	6,000 lbs.
Bulk Explosive Unpacking Building	-	6,000 lbs.
Vacuum Collector Building (per Bay)	-	200 lbs.
Settling Reservoirs (part of Pollution Abatement Facility and/or Explosive Collection Systems)	-	1,000 lbs.
Melter Building (per Bay)	-	2,000 lbs.
Load Building (per Bay)	-	2,000 lbs.
Riser Melter Building (per Bay)	-	3,000 lbs.
Riser Melter Building (in separate bay of Melter Building)	-	2,000 lbs.
Cast Finishing Building (per Bay)	-	2,000 lbs.
Cooling Igloo	-	18,000 lbs.
Cooling Building (per Bay)	-	5,000 lbs.
Assembly Building (per Bay)	-	2,000 lbs.
Packout Building (per Bay)	-	5,000 lbs.
Pollution Abatement Process Facility	-	1,000 lbs.
X-Ray Inspection Building (per Bay)	-	2,000 lbs.
X-Ray Hold Igloo	-	30,000 lbs.
Service Magazines - normally 4-hour need but not more than 1 day's production (3-shift basis)		
Loaded Cartridge Case Storage Magazine (Class 2 and 2A)	-	40,000 lbs.
Shipping Facilities (per Bay)	-	50,000 lbs.

2. Bulk Explosive Receiving, Inspection (and/or Screening) and Unpacking Buildings (Plate No. 5.1)

Bulk Explosive Inspection and Unpacking Buildings shall be separated from Receiving Buildings by unbarricaded intraline distances based upon the quantity of explosive in the Inspection or Unpacking

Buildings. However, both the Inspection and the Unpacking Buildings shall be barricaded from the Receiving Building and, if possible, the receiving platforms should be located on the side of the Receiving Building away from that of the Inspection Building.

Personnel may be located in the Receiving and Unpacking Buildings and where tote bins are used for packaging of bulk explosives, personnel may be permitted to enter the Inspection Building to replace empty bins with full bins. In all other cases, personnel shall not enter the Inspection Building and all other operations in the inspection process shall be performed remotely. Cardboard boxes used for shipping bulk explosives may be opened in the Receiving Building; however, movement of the boxes to the Inspection Building as well as opening of the inner plastic liners of the boxes shall be performed by remote operation. The plastic liners of the cardboard boxes may be opened in the Unpacking Building and, if desired, the bulk explosive may be placed in tote bins for movement to the Inspection Building. Separation of the Inspection Building from the Unpacking Building shall conform to intraline distances based upon the larger quantity of explosive in either building.

Any one Inspection Building shall have a maximum of two inspection bays. Each bay shall have an independent access and shall be so arranged that the explosive being delivered to one bay will not pass the open sides of the other bay. Unless the operation is performed remotely, the use of separate bays in an Inspection Building for opening cardboard boxes and/or plastic liners shall not be permitted.

Bulk Explosive Receiving and Unpacking Buildings should usually be constructed above ground and should be capable of resisting effects associated with a blast overpressure of at least 1.2 psi. The Inspection Building, on the other hand, may be positioned above and/or below grade, in accordance with effective barricading requirements previously stated. In most cases, the below ground structure concept will be the more economical arrangement in addition to providing the maximum protection.

Transfer of explosives between the Inspection Building and the Melt Building may be accomplished with the use of either a mechanical or pneumatic conveyance system.

Mechanical conveyance systems shall be so designed to prevent propagation of explosion from one building to the other. This may be accomplished either by the development of specially designed conveyors for continuous feed or by safe spacing (and/or shielding) when the explosive is conveyed in lots. Both continuous feed or batching systems safety concept designs shall be verified by testing.

Until determined otherwise, pneumatic lines leading from an Inspection Building to a Melter Building shall be provided with detonation traps and/or other positive means to prevent a propagation of explosion through the pneumatic lines. A set of two-detonation traps shall be positioned every 30 feet along the pneumatic lines for the full run of the lines between the buildings. In the event that the portion of the Inspection Building where the pneumatic lines exit from the building is barricaded, then a portion of the lines extending a distance of approximately 30 feet away from the building (two sets of detonation traps) shall also be barricaded. Positioning this portion of the pneumatic lines below the grade is considered as effective barricading.

A pneumatic line leading from a given inspection bay shall not be connected to another pneumatic line leading from another inspection bay. In the event it is desirable to position several pneumatic lines in close proximity to one another, then sufficient safe spacing and/or shielding should be provided to insure against propagation of explosion from one line to the others. The required spacing (and/or shielding) shall be established by testing.

3. Melter Building (Plate No. 5.2)

The Melter Building shall contain only the melting operation of a LAP facility. Both bulk explosives and risers may be melted in the Melter Building; however, each melting operation shall be located within separate bays. No more than 50 percent of the melting capacity of a LAP facility shall be located in any one Melter Building.

All operations within a Melter Building shall be performed remotely.

Melter Buildings may be a single storied structure above ground or fully or partially below grade. All exterior walls of the above-ground structures shall be designed to resist the blast effects of an explosion within the building and with response limits equal to or less than incipient failure.

Because of the high hazard (Hazard Category IV) associated with the melting operation, it is desirable to position Melter Buildings as far away as possible from other facility structures. Separations which correspond to inhabited building distances based upon the explosive quantity in the melter are more desirable between Melter Buildings and buildings containing personnel such as metal parts and control buildings, lunch change houses, etc. However, when real estate is not available, intraline distances may be used. However, where possible, use of barricaded intraline distances should be avoided. Positioning of Melter Buildings relative to the Bulk Receiving Building should also be based on inhabited building distances as specified by the explosive quantity in the melter but shall

be at least equal to intraline distances based upon the quantity of explosive in the Receiving Building. Building separation between Melter and Inspection Buildings shall be at least equal to intraline distances as required for the explosive quantity in the Inspection Building. However, each of these buildings shall be designed to provide full protection for its contents from the effects (both blast and fragments) of an explosion in one of the adjoining structures.

Exterior pneumatic and hydraulic lines leading from the Melter Building to the Inspection and Load Buildings, respectively, shall be provided with detonation traps and/or other effective means to prevent propagation of explosion between the respective buildings. In addition, where both riser melters and bulk explosive melters are located within the same Melter Building, the hydraulic lines leading from the riser melter area to the bulk explosive melter area shall be equipped with positive means to negate explosion propagation between bays. A set of two-detonation traps shall be positioned every 30 feet along the entire length of each pneumatic and hydraulic line. In the event that the Melter Building is barricaded, then each line extending approximately 30 feet away from the building (two sets of detonation traps) shall also be barricaded. Positioning of each line below the grade is considered as an effective means of barricading.

The pneumatic and hydraulic lines from individual bays shall not be connected together and, if it is found desirable to locate several lines in close proximity to one another, then safe spacing and/or shielding should be provided to prevent explosion propagation between lines. The required protection shall be established by testing.

In the event mechanical conveyance is used to transfer explosives between the Inspection and the Melt Buildings, then the means for preventing propagation of explosion as discussed previously for the Inspection Building shall be applicable for the Melt Building.

4. Explosive Load Building

The Explosive Load Building shall contain only the explosive loading operation of a LAP installation. Both molten and flake (in the case of TNT) explosives may be loaded into projectile shells. No more than 50 percent of the explosive loading capacity of a LAP facility shall be located in any one Load Building.

All operations in a Load Building shall be performed remotely.

The Load Building shall be an above-grade structure. Individual operating bays shall be separated by dividing walls with a structural response which shall not exceed incipient failure.

Separating distances between Load Buildings and adjoining buildings shall be the same as those separation distances specified for the Melter Buildings. However, intraline distances may be used for separating Melt Buildings from their corresponding Load Buildings.

Hydraulic explosive lines leading from the Melter Building shall be equipped with detonation traps and/or other means to prevent propagation. The hydraulic line entering a loading bay shall be an independent line and not connected to a main hydraulic line for a distance of at least 30 feet (two sets of detonation traps) away from the building. In the event that the Load Building is barricaded, then the hydraulic lines extending approximately 30 feet away from the building shall also be barricaded. Positioning of hydraulic lines below the ground surface is considered as an effective means of barricading.

Individual hydraulic lines which are located in close proximity to one another shall be separated by safe separation distances and/or shielding which shall be established by testing.

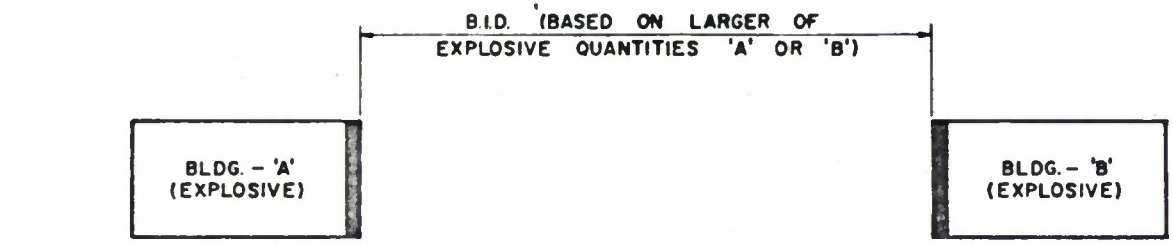
5. Combined On-Line Storage, Assembly and Packout Building (Plate No. 5.3)

Two major special safety concepts shall be considered for the design of a combined On-Line Storage-Assembly and Packout Buildings for LAP facilities, namely, (1) the three principal operations (storage, assembly and packout) must be separated from one another by effective dividing walls, and (2) the total quantity of explosives in an on-line storage building to be used for the design of the protective wall and quantity-distance purposes shall be based upon the explosive quantity in the largest stack of explosives when other smaller stacks of explosives in the same area are separated from the main stack and from one another by safe separation distances specified for ammunition on conveyors (Table 17.1, AMCR 385-100) and/or as established by safe separation tests.

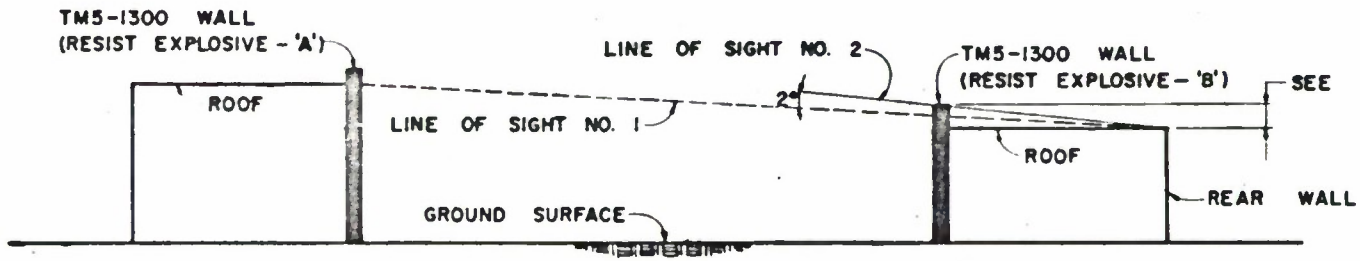
Application of these two special safety concepts is illustrated in Plate No. 5.3.

NOTES:

1. EQUAL TO AT LEAST 3 FEET OR AS DEFINED BY LINE OF SIGHT NO. 2.



PLAN



ELEVATION

DIVIDING WALL ARRANGEMENT TYPE No. 1

(EXPLOSIVE 'A' ≈ EXPLOSIVE 'B')

REVISION	DATE	DESCRIPTION	BY	APPROVAL

PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

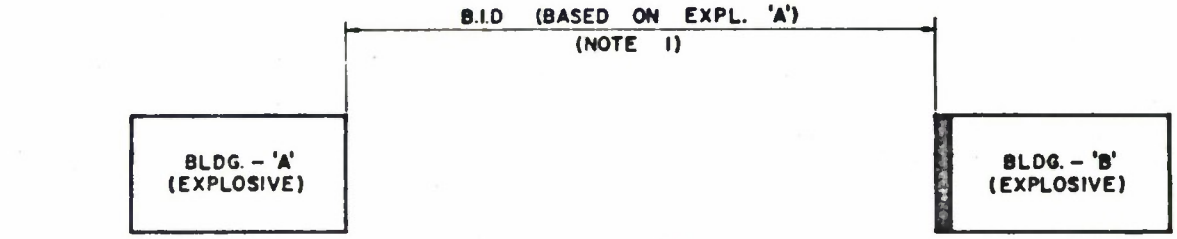
PLATE No. 1.1

EFFECTIVE BARRICADING OF BUILDINGS

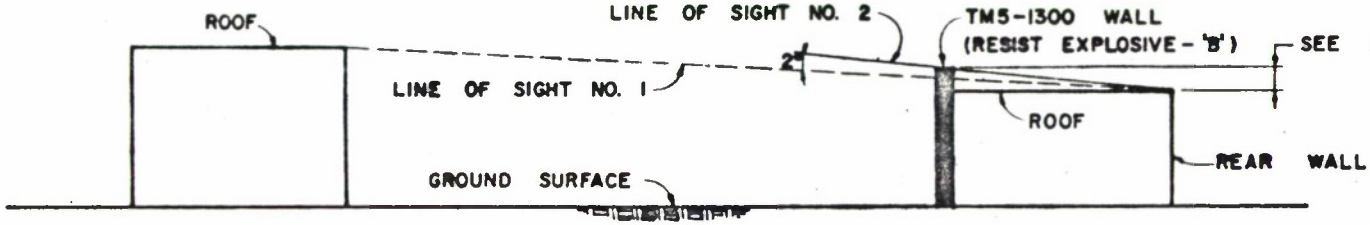
APPROVED		
DRAWN BY: C.N.T.	CHECKED BY: K.A.G.	SCALE
SUBMITTED: J. Dobbis	DATE: OCT. 16, 19[illegible]	DWG. NO.

NOTES:

1. FOR THIS SCHEME TO BE APPLICABLE, B.I.D. (BASED ON EXPL. 'A') MUST BE EQUAL TO OR GREATER THAN U.B.I.D. (BASED ON EXPL. 'B').
2. EQUAL TO AT LEAST 3 FEET OR AS DEFINED BY LINE OF SIGHT NO. 2.



PLAN



ELEVATION

DIVIDING WALL ARRANGEMENT TYPE No. 2

(EXPLOSIVE 'A' > EXPLOSIVE 'B')

REVISION	DATE	DESCRIPTION	BY	APPROVAL

PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

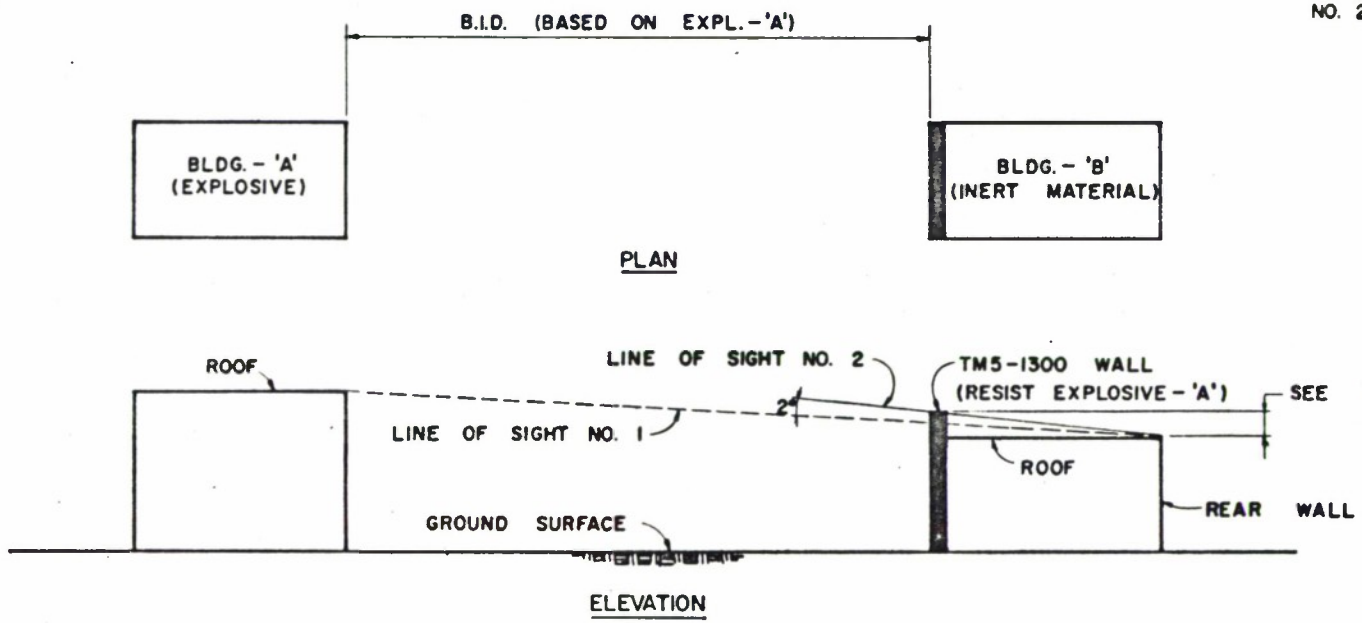
PLATE No. 1.2

EFFECTIVE BARRICADING OF BUILDINGS

APPROVED R.E. Fischer 10-16-72		
DRAWN BY C.N.T.	CHECKED BY K.A.G.	SCALE
SUPERVISED M. Dobbs	DATE OCT 16 72	DWG. NO.

NOTES:

1. EQUAL TO AT LEAST 3 FEET OR AS DEFINED BY LINE OF SIGHT NO. 2.



DIVIDING WALL ARRANGEMENT TYPE No. 3

REVISION	DATE	DESCRIPTION	BY	APPROVAL

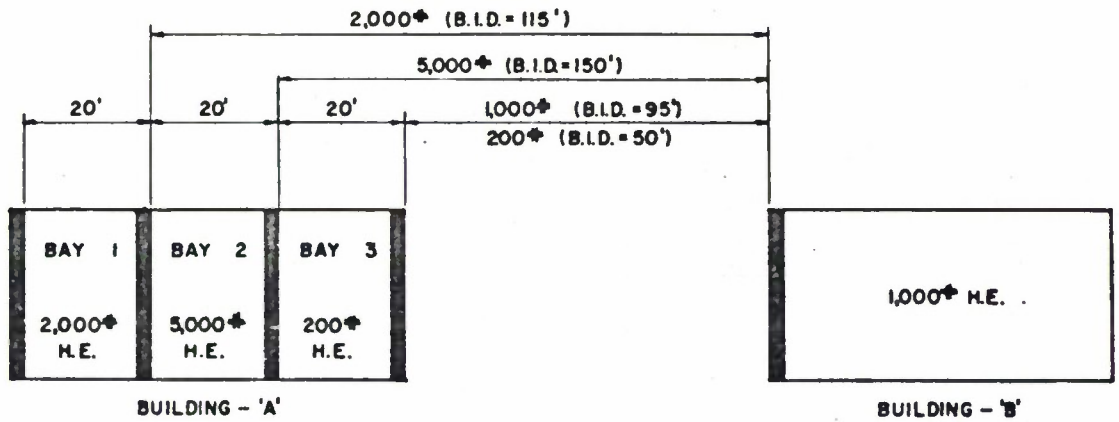
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 1.3

EFFECTIVE BARRICADING OF BUILDINGS

APPROVED L.E. Beale 10-17-72		
DRAWN BY CNT	CHECKED BY AAG	SCALE
SUBMITTED M. Dobbs	DATE OCT 16, 72	DWG. NO.



MULTI-CELL STRUCTURES

(EXAMPLE No. 1)

REVISION	DATE	DESCRIPTION	BY	APPROVAL

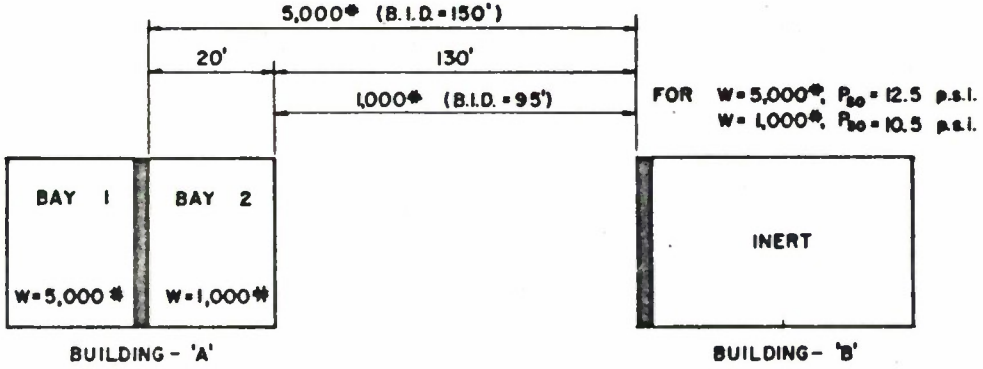
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 1.4

EFFECTIVE BARRICADING OF BUILDINGS

APPROVED: L.D. Pinkston 10-17-72		
DRAWN BY: C N T	CHECKED BY: K A G	SCALE:
SUBMITTED: W Dobbs	DATE: OCT. 16, 72	DWG. NO.



MULTI-CELL STRUCTURES
(EXAMPLE No. 2)

REVISION	DATE	DESCRIPTION	BY	APPROVAL

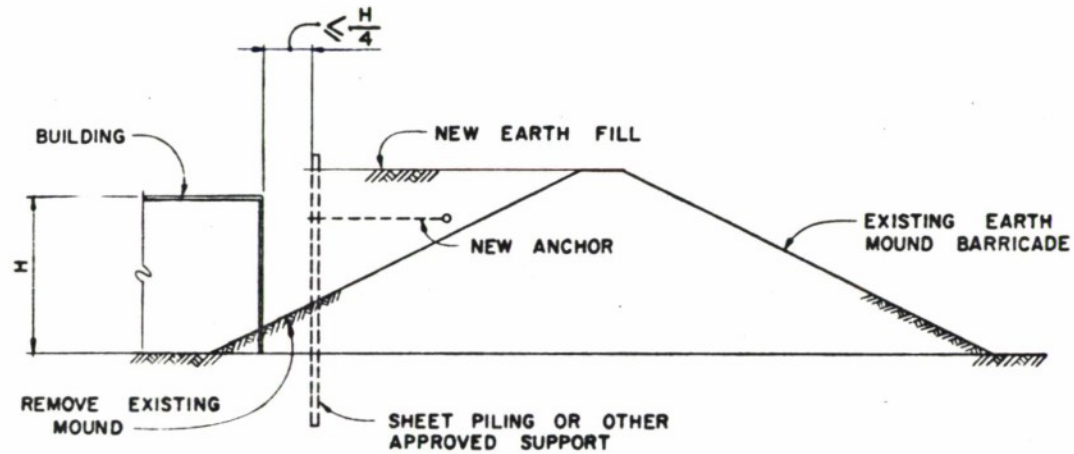
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 1.5

EFFECTIVE BARRICADING OF BUILDINGS

APPROVED P.F. Linker 10-17-72		
DRAWN BY C.N.T.	CHECKED BY K.A.G.	SCALE
SUBMITTED M. Dobbs	DATE OCT 16, 72	DWG. NO.



EARTH MOUND BARRICADE
(NOT AN EFFECTIVE BARRICADE)

REVISIONS	DATE	DESCRIPTION	BY	APPROVAL

PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

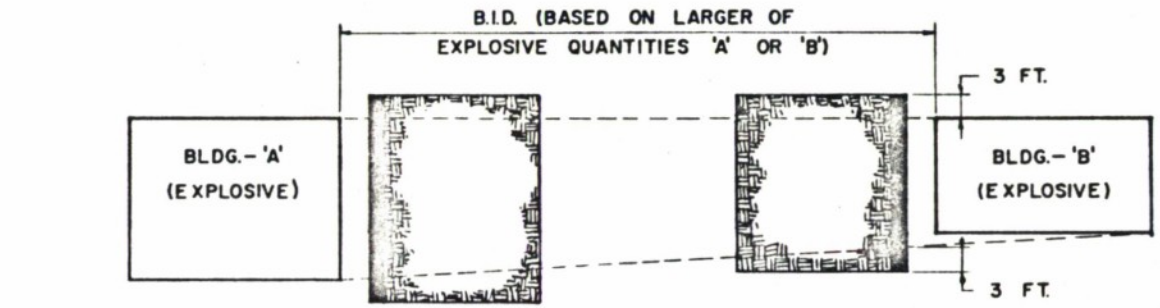
PLATE No. 1.6

EFFECTIVE BARRICADING OF BUILDINGS

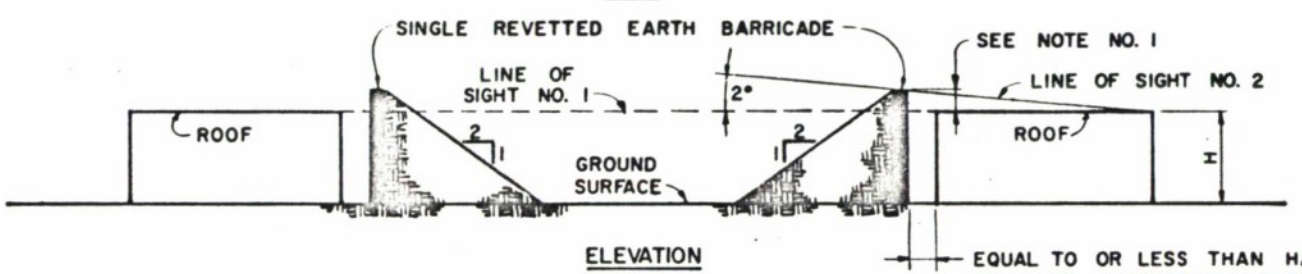
APPROVED R.C. Huber 10-17-72		
DRAWN BY C.N.T.	CHECKED BY K.A.G.	SCALE -
SUBMITTED N. Dobbs	DATE OCT 1972	DWG. NO.

NOTES:

1. EQUAL TO SEPARATION DISTANCE BETWEEN BARRICADE AND BUILDING BUT NOT LESS THAN 3 FEET OR AS DEFINED BY LINE OF SIGHT NO. 2.
2. FOR TWO BUILDINGS OF DIFFERENT HEIGHTS, SEE NOTE 2 OF PLATE NO. 1.8



PLAN



ELEVATION

BARRICADE ARRANGEMENT No. 1

(EXPLOSIVE 'A' ≈ EXPLOSIVE 'B')

REVISIONS	DATE	DESCRIPTION	BY	APPROVAL

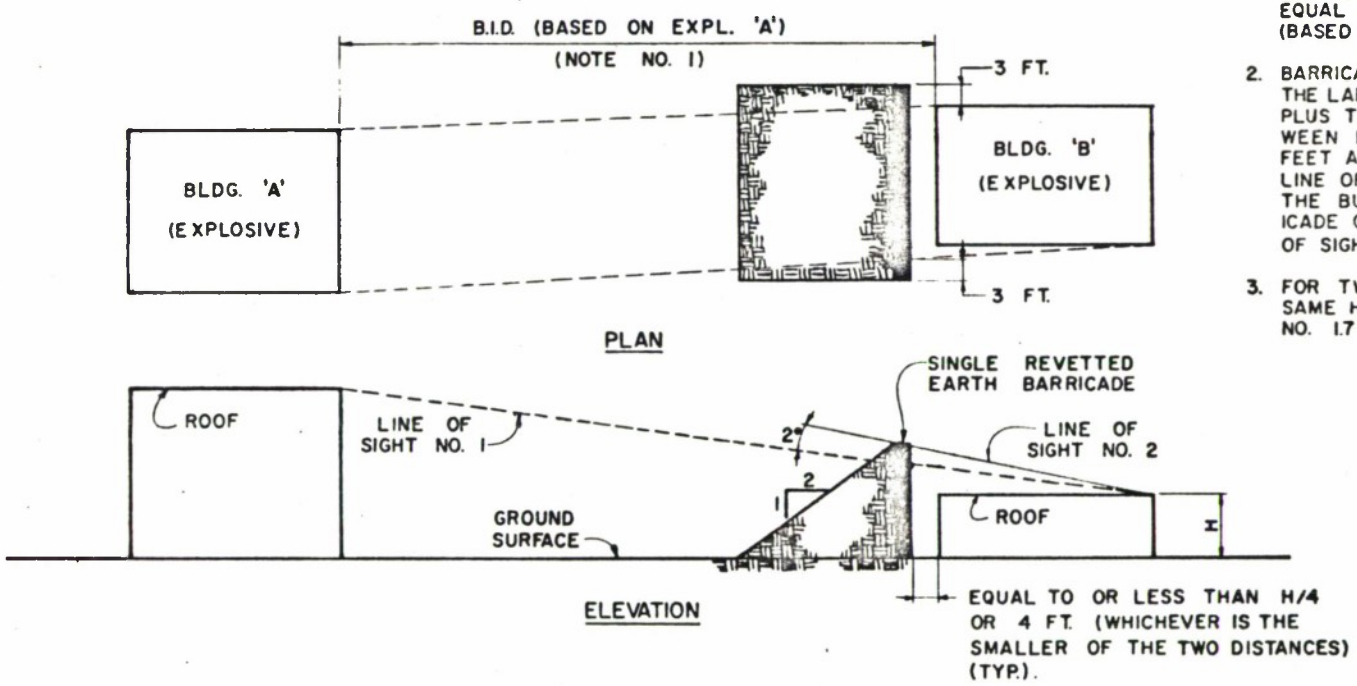
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 1.7

EFFECTIVE BARRICADING OF BUILDINGS

APPROVED R.C. Parker 10-7-72		
DRAWN BY CJT	CHECKED BY FAG	SCALE
SUBMITTED	DATE OCT 6 72	DWG. NO.



BARRICADE ARRANGEMENT No. 2

(EXPLOSIVE 'A' > EXPLOSIVE 'B')

NOTES:

1. FOR THIS SCHEME TO BE APPLICABLE, B.I.D (BASED ON EXPL. 'A') MUST BE EQUAL TO OR GREATER THAN U.B.I.D (BASED ON EXPL. 'B').
2. BARRICADE HEIGHT TO BE EQUAL TO THE LARGER OF THE BUILDING HEIGHT PLUS THE SEPARATION DISTANCE BETWEEN BUILDING AND BARRICADE, OR 3 FEET ABOVE THE POINT WHERE THE LINE OF SIGHT BETWEEN THE TOPS OF THE BUILDING PASS THRU THE BARRICADE OR AS DEFINED BY THE LINE OF SIGHT NO. 2.
3. FOR TWO BUILDINGS HAVING THE SAME HEIGHT, SEE NOTE 1 OF PLATE NO. 1.7

REVISION	DATE	DESCRIPTION	BY	APPROVAL

PICATINNY ARSENAL
DOVER, NEW JERSEY
PREPARED BY
AMMANN & WHITNEY, CONSULT ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

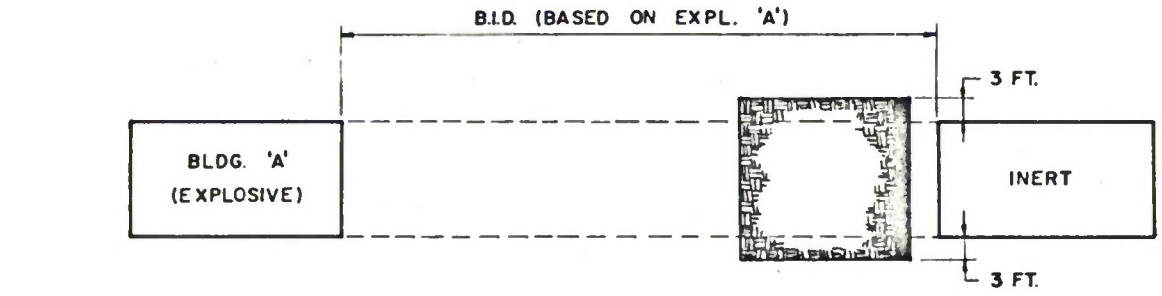
PLATE No. 1.8

EFFECTIVE BARRICADING OF BUILDINGS

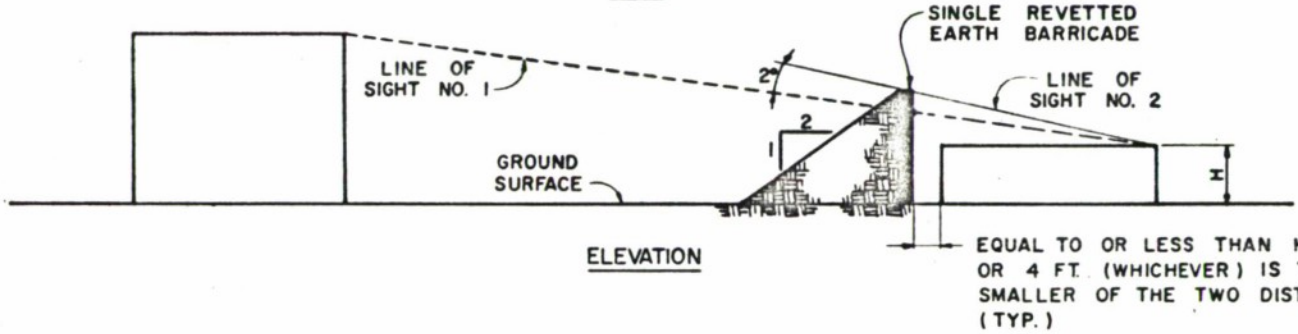
APPROVED		
DRAWN BY C N T	CHECKED BY K A G	SCALE
SUBMITTED M. Dobbs	DATE OCT 16, 72	DWG. NO.

NOTES:

1. BARRICADE HEIGHT TO BE EQUAL TO THE LARGER OF THE BUILDING HEIGHT PLUS THE SEPARATION DISTANCE BETWEEN BUILDING AND BARRICADE, OR 3 FEET ABOVE THE POINT WHERE THE LINE OF SIGHT BETWEEN THE TOPS OF THE BUILDING PASS THRU THE BARRICADE OR AS DEFINED BY THE LINE OF SIGHT NO. 2.
2. FOR TWO BUILDINGS HAVING THE SAME HEIGHT, SEE NOTE 1 OF PLATE NO. 1.7.



PLAN



ELEVATION

BARRICADE ARRANGEMENT No. 3

REVISION	DATE	DESCRIPTION	BY	APPROVAL

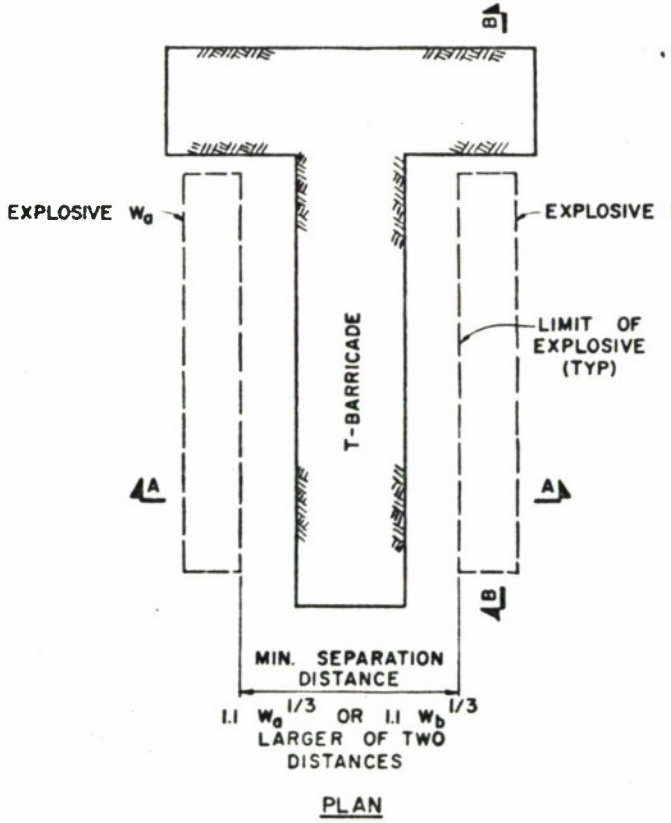
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

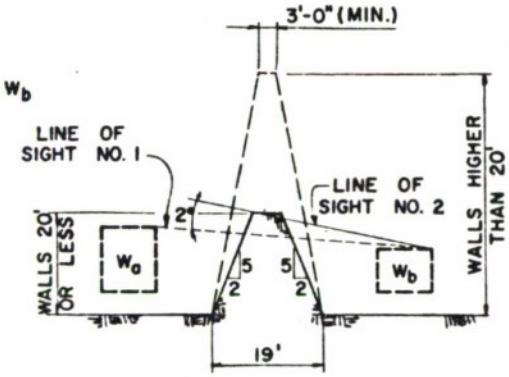
PLATE No. 1.9

EFFECTIVE BARRICADING OF BUILDINGS

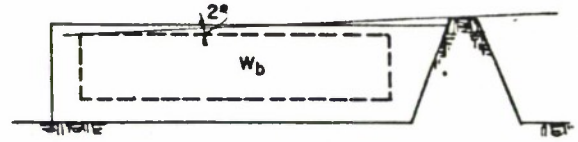
APPROVED R.O. Parker 10-17-72		
DRAWN BY CJT	CHECKED BY KAG	SCALE
SUBMITTED M Dobbs	DATE OCT 16, 72	DWG. NO.



PLAN



SECTION A-A



SECTION B-B

NOTES

1. HEIGHT OF BARRICADE TO EXTEND 6 FEET ABOVE THE HIGHEST EXPLOSIVE CHARGE OR AS DEFINED BY LINE OF SIGHT NO. 2. BUT NOT LESS THAN THE BUILDING HEIGHT.
2. MAXIMUM EXPLOSIVE QUANTITY (W_a OR W_b) NOT TO EXCEED 50,000 POUNDS.

EFFECTIVE TEE BARRICADE

REVISION	DATE	DESCRIPTION	BY	APPROVAL

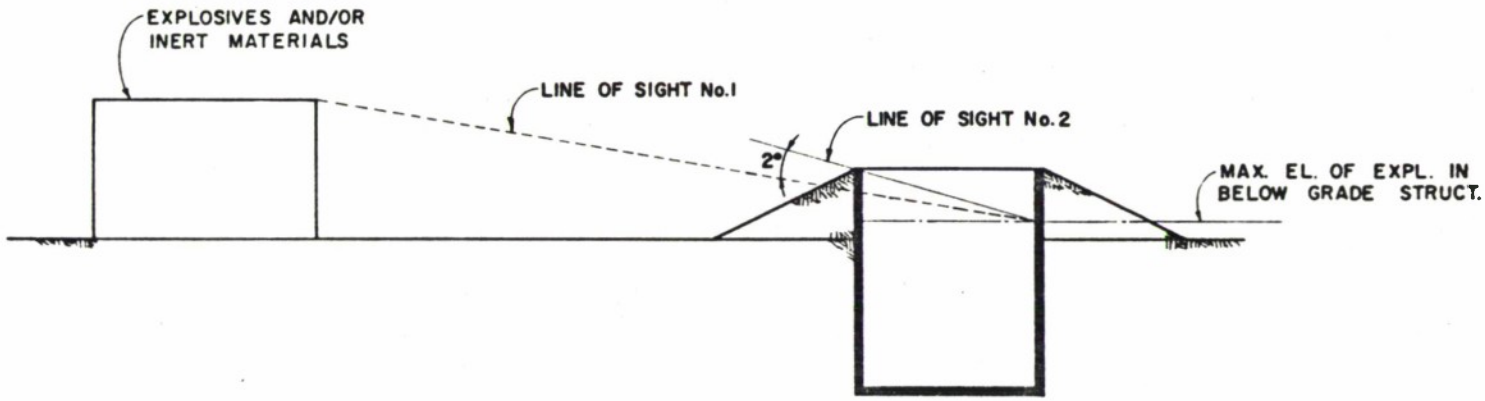
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 1.10

EFFECTIVE BARRICADING OF BUILDINGS

APPROVED		
DRAWN BY CNT	CHECKED BY KAG	SCALE
SUBMITTED	DATE OCT 16, 72	DWG. NO.



CRITERIA FOR EFFECTIVELY BARRICADED BELOW-GRADE BUILDINGS

REVISION	DATE	DESCRIPTION	BY	APPROVAL
1	24			NO

PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

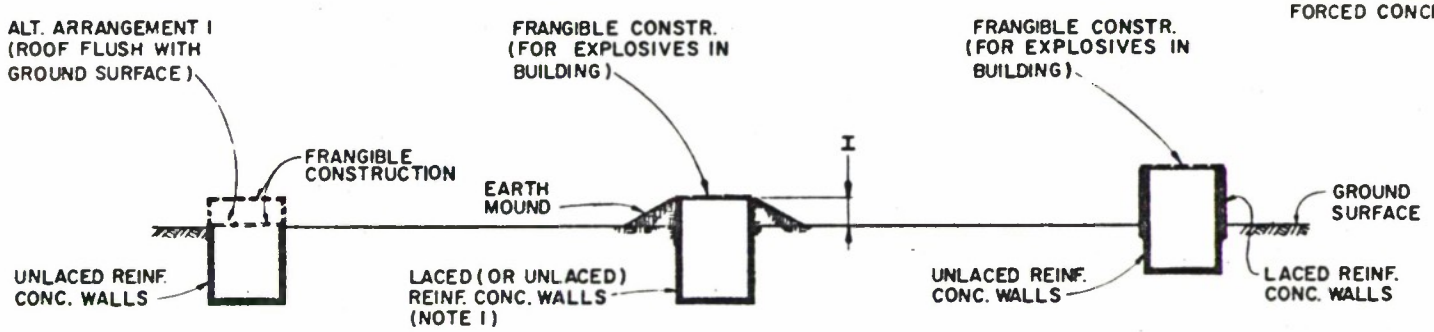
PLATE No. LII

EFFECTIVE BARRICADING OF BUILDINGS

APPROVED [signature] 0-14-72		
DRAWN BY CNT	CHECKED BY KAG	SCALE
SUBMITTED [signature]	DATE OCT. 16, 72	DWG. NO.

NOTES:

1. WALL HEIGHT (H) EQUAL TO OR LESS THAN 10 FEET. UNLACED REINFORCED CONCRETE MAY BE USED.
2. EXCEPT AS NOTED ABOVE, ALL ABOVE-GROUND WALLS SHALL BE LACED REINFORCED CONCRETE.



ARRANGEMENT 1
ALL EXPLOSIVES BELOW GRADE

ARRANGEMENT 2
EXPLOSIVES ABOVE AND BELOW GRADE

ARRANGEMENT 3
EXPLOSIVES ABOVE AND BELOW GRADE

TYPES OF BELOW-GRADE EFFECTIVELY BARRICADED BUILDINGS

REVISION	DATE	DESCRIPTION	BY	APPROVAL

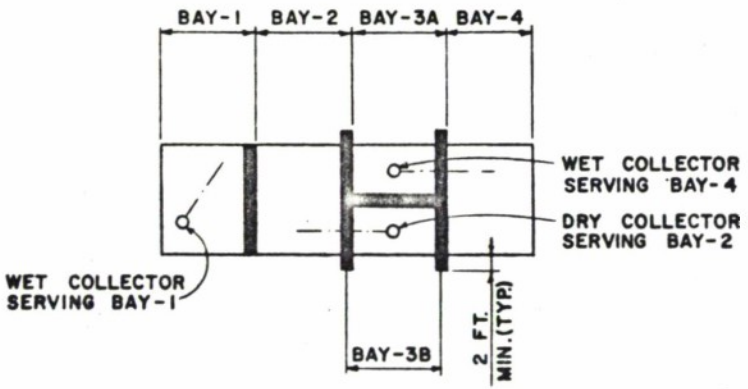
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No 1.12

EFFECTIVE BARRICADING OF BUILDINGS

APPROVED K.C. Parker 10-17-72		
DRAWN BY CNT	CHECKED BY KAG	SCALE -
SUBMITTED M. Dobbs	DATE OCT 16, 72	DWG NO.



PLAN

EXPLOSIVE COLLECTORS
(IN OPERATING BUILDINGS)

NOTES:

1. WET COLLECTOR MAY BE LOCATED IN THE OPERATING BAY IT IS SERVING OR IN A SEPARATE BAY.
2. EACH DRY COLLECTOR SHALL BE LOCATED IN A SEPARATE BAY ENCLOSED BY THREE WALLS.
3. COLLECTOR BAYS SHALL NOT BE USED FOR OTHER OPERATIONS OR AS COMMUNICATING CORRIDORS OR PASSAGE-WAYS.
4. MAXIMUM EXPLOSIVE QUANTITY ACCUMULATED IN ANY ONE COLLECTOR OR SERIES OF COLLECTORS IN ANYONE OPERATING BAY SHALL NOT EXCEED 5 POUNDS.

REVISION	DATE	DESCRIPTION	BY	APPROVAL

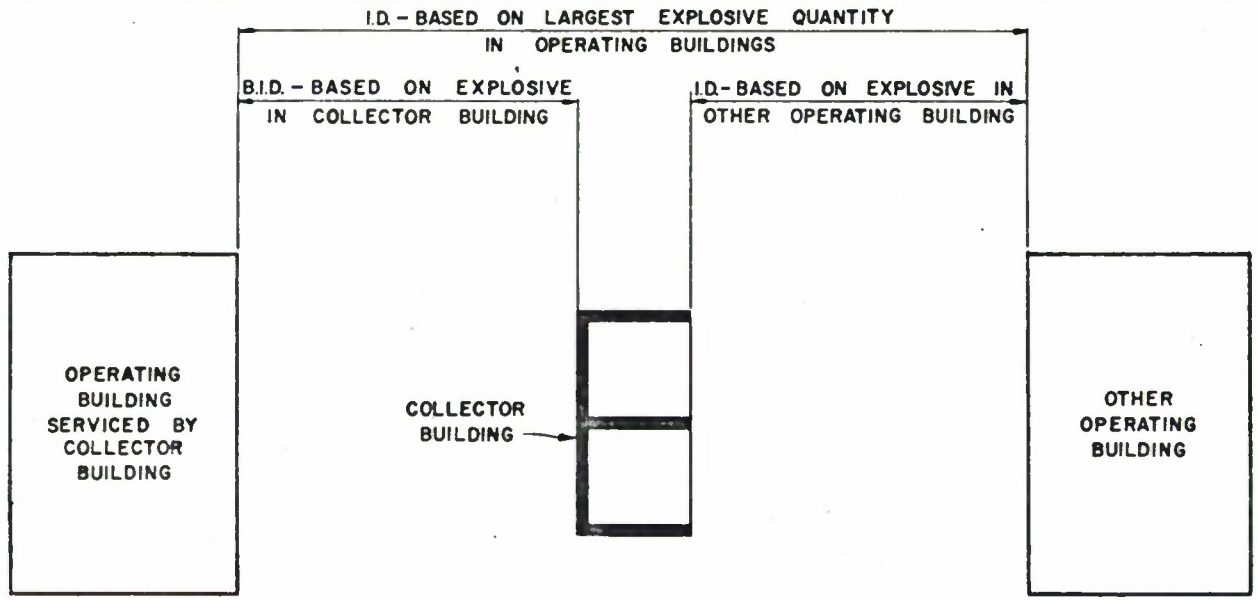
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 2.1

EXPLOSIVE COLLECTION FACILITIES

APPROVED		
DRAWN BY: CNT	CHECKED BY: KAG	SCALE
SUBMITTED: M. Dobbs	DATE: OCT 16, 1972	DWG. NO.



QUANTITY-DISTANCE SEPARATION BETWEEN
COLLECTOR & OPERATING BUILDINGS

REVISION	DATE	DESCRIPTION	BY	APPROVAL

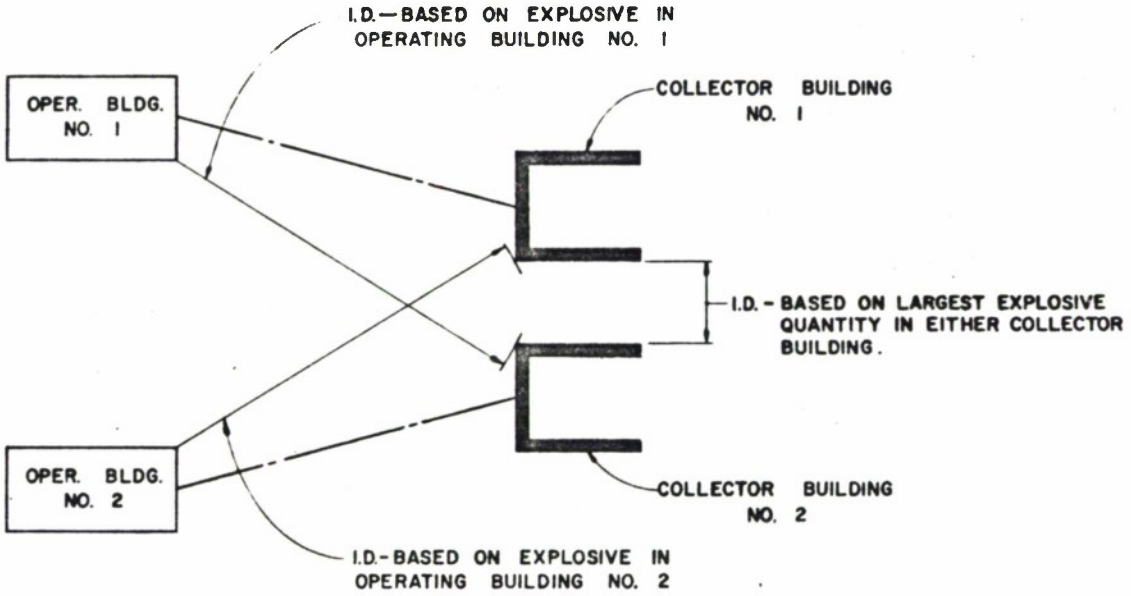
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 2.2

EXPLOSIVE COLLECTION FACILITIES

APPROVED P.E. Clarke 10-17-72		
DRAWN BY C N T	CHECKED BY K A G	SCALE
SUBMITTED M Dobbs	DATE OCT 6, 72	DWG. NO.



SEPARATION DISTANCE BETWEEN VACUUM COLLECTOR BUILDINGS

REVISION	DATE	DESCRIPTION	BY	APPROVAL

PICATINNY ARSENAL
DOVER, NEW JERSEY

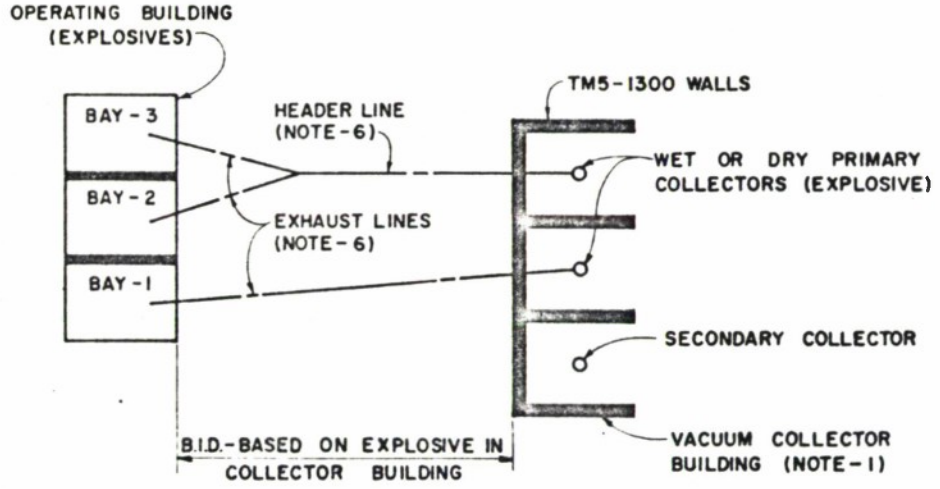
PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 2.3

EXPLOSIVE COLLECTION FACILITIES

APPROVED [signature] 11-17-72

DRAWN BY	CHECKED BY	SCALE
CNJ	KAG	
SUBMITTED [signature]	DATE OCT 6, 72	DWG. NO.



PLAN

EXPLOSIVE COLLECTORS

(EXTERIOR OF OPERATING BLDG'S)

NOTES:

1. A VACUUM COLLECTOR BUILDING SHALL SERVE NO MORE THAN ONE OPERATING BUILDING.
2. ACCUMULATION OF MORE THAN 5 POUNDS OF EXPLOSIVES (AT ANY ONE TIME) WITHIN AN OPERATING BAY SHALL BE ACCOMPLISHED IN A COLLECTOR BUILDING SEPARATED FROM THE OPERATING BUILDING IT IS SERVING.
3. WHERE POSSIBLE EACH OPERATING BAY SHOULD BE SERVICED BY A SEPARATE COLLECTOR IN THE COLLECTOR BUILDING. HOWEVER, A SINGLE COLLECTOR IN THE COLLECTOR BUILDING SHALL SERVICE NO MORE THAN TWO OPERATING BAYS WHEN SEPARATE EXHAUST LINES ARE PROVIDED FOR EACH BAY. THE TWO EXHAUST LINES MAY BE CONNECTED TO A SINGLE HEADER LEADING TO THE VACUUM COLLECTOR.
4. EACH VACUUM COLLECTOR SHALL BE LOCATED IN A SEPARATE BAY IN THE COLLECTOR BUILDING.
5. A SECONDARY COLLECTOR (WET OR DRY) SHALL SERVICE NO MORE THAN TWO PRIMARY COLLECTORS.
6. EXPLOSIVE COLLECTOR &/OR WASTE LINES SHALL BE PROVIDED WITH DETONATION TRAPS OR OTHER POSITIVE MEANS TO PREVENT PROPAGATION OF EXPLOSIVES BETWEEN VACUUM COLLECTOR & OPERATING AREAS & OTHER EXPLOSIVE COLLECTION FACILITIES.
7. A CENTRALLY LOCATED POLLUTION ABATEMENT PROCESSING FACILITY MAY BE USED TO SERVE MORE THAN ONE VACUUM COLLECTOR BUILDING & SHALL BE LOCATED AT MINIMUM INTRALINE DISTANCE FROM OTHER FACILITY COMPONENTS.

REVISION	DATE	DESCRIPTION	BY	APPROVAL

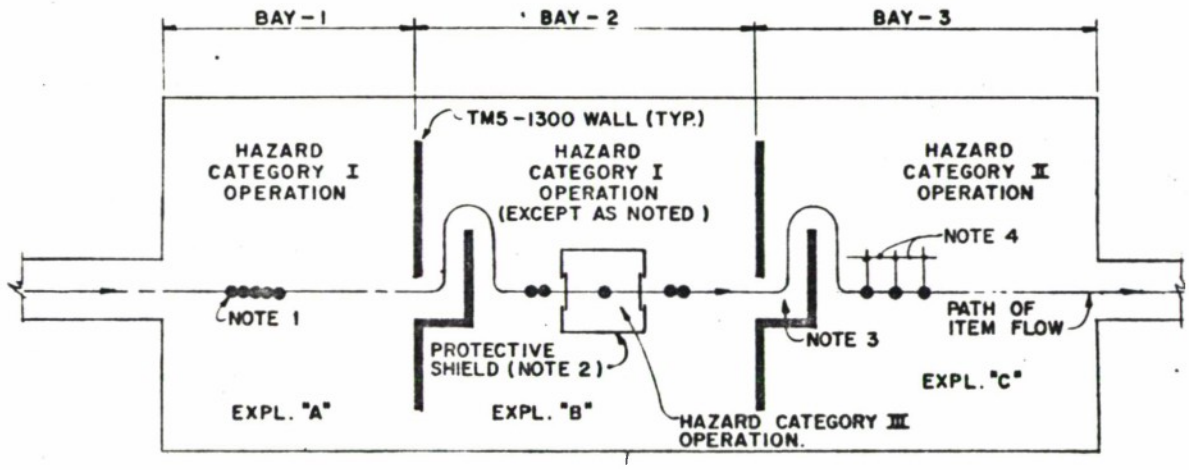
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 2.4

EXPLOSIVE COLLECTION FACILITIES

APPROVED: [signature] 11-14-72		
DRAWN BY: CNT	CHECKED BY: KAG.	SCALE
SUBMITTED	DATE: OCT 16, 72	DWG. NO.



PLAN

NOTES:

1. NO ITEM SEPARATION REQUIRED FOR HAZARD CATEGORY I OPERATIONS.
2. PROTECTIVE SHIELD SHALL BE DESIGNED FOR THE EXPLOSIVE QUANTITY CONTAINED THEREIN TO PROTECT PERSONNEL AND EQUIPMENT OUTSIDE THE SHIELD FOR HAZARD CATEGORY III OPERATIONS.
3. MAZES OR OTHER EFFECTIVE MEANS SHALL BE PROVIDED TO (1) PREVENT A DIRECT LINE OF SIGHT BETWEEN ITEMS IN ADJOINING BAYS, AND (2) REDUCE THE SEPARATION DISTANCES BETWEEN THIS BUILDING AND THE ADJOINING BUILDINGS FROM THAT REQUIRED FOR TOTAL QUANTITY OF EXPLOSIVE IN THIS BUILDING TO THAT NEEDED FOR THE QUANTITY OF EXPLOSIVE IN INDIVIDUAL BAYS OF THIS BUILDING.
4. SAFE SPACING OR SHIELDING BETWEEN ITEMS REQUIRED FOR HAZARD CATEGORY II OPERATIONS (TO BE ESTABLISHED BY TESTING).

HAZARD CATEGORY DESCRIPTION

REVISION	DATE	DESCRIPTION	BY	APPROVAL

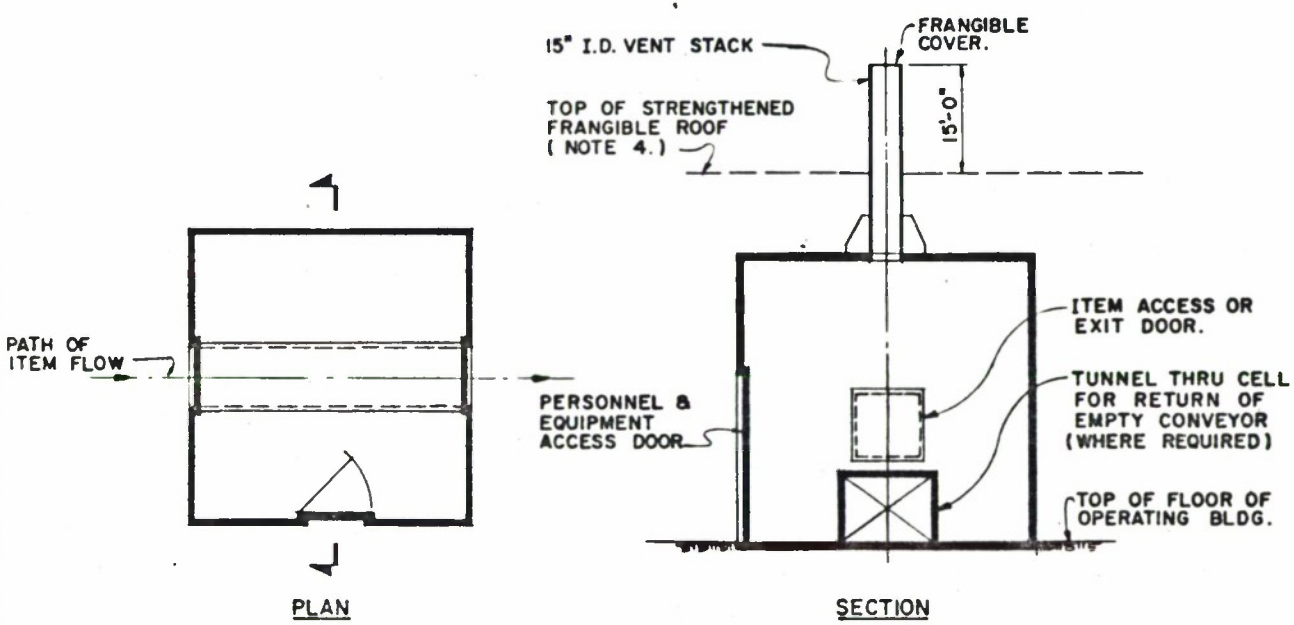
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 3.1

TRANSFER OF EXPLOSIVES THROUGH BUILDINGS

APPROVED		
DRAWN BY: CNT	CHECKED BY: KAG	SCALE
SUBMITTED: N. Dobbs	DATE: OCT 16, 72	DWG. NO.



NOTES:

1. MAX. QUANTITY OF EXPLOSIVE WITHIN THE SHIELD SHALL NOT EXCEED 15 POUNDS. LARGER QUANTITIES OF EXPLOSIVE SHALL BE LOCATED IN SEPARATE OPERATING BUILDINGS.
2. SHELL, DOORS & VENT STACK SHALL BE CAPABLE OF RESISTING THE BLAST AND FRAGMENT (PRIMARY & SECONDARY) EFFECTS OF AN EXPLOSION WITHIN THE SHIELD.
3. ALL DOORS SHALL BE CLOSED DURING PERFORMANCE OF HAZARDOUS OPERATIONS.
4. FRANGIBLE PORTION OF THE OPERATING BLDG. SURROUNDING THE SHIELD SHALL HAVE SUFFICIENT STRENGTH TO RESIST A BLAST PRESSURE OF 1.2 p.s.i..
5. ALL HAZARD CATEGORY III OPERATIONS SHALL BE PERFORMED REMOTELY.

HAZARD CATEGORY III OPERATIONAL SHIELD

REVISION	DATE	DESCRIPTION	BY	APPROVAL

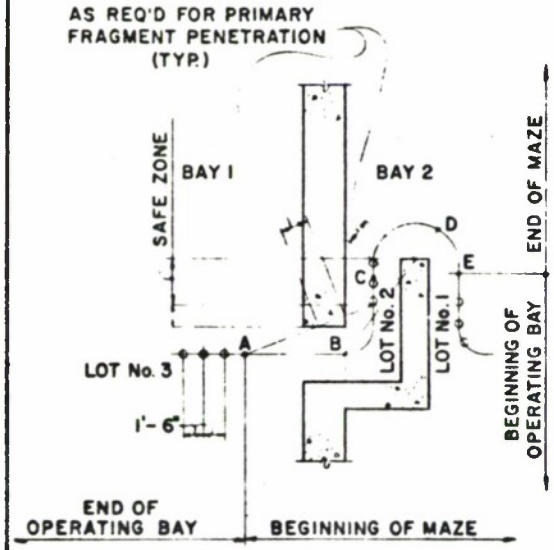
PICATINNY ARSENAL
DOVER, NEW JERSEY

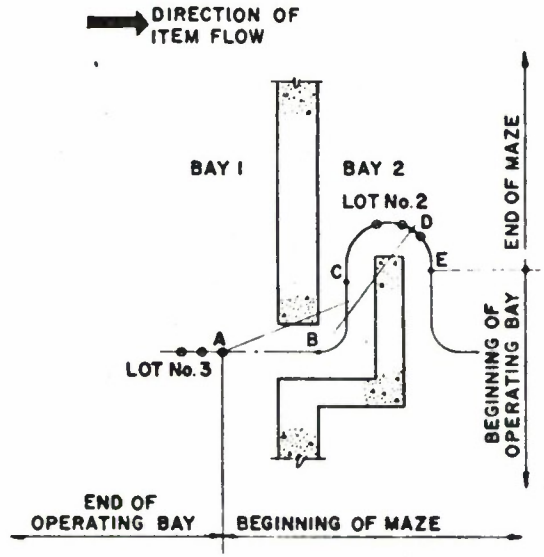
PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

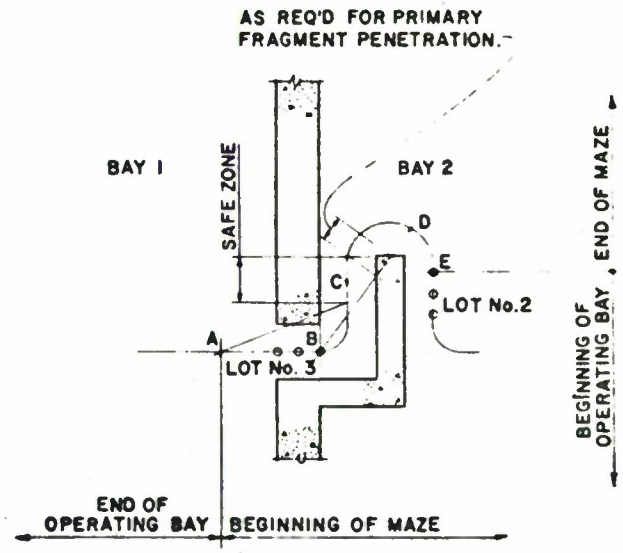
PLATE No. 3.2

TRANSFER OF EXPLOSIVES THROUGH BUILDINGS

APPROVED: E.E. Ricker 10-17-72		
DRAWN BY: C.N.T.	CHECKED BY: K.A.G.	SCALE
SUBMITTED: M. Dabbs	DATE: OCT. 16, 72	DWG. NO.







STAGE NO. 1

LOT #1 IN OPERATING BAY 2 (LAST ITEM AT OR AFTER POINT E)

LOT #2 IN SAFE ZONE (SAFE FROM PROPAGATION FROM BOTH OPERATING BAYS 1 & 2)

LOT #3 IN OPERATING BAY (FIRST ITEM AT OR BEFORE POINT A)

STAGE NO. 2

LOT #2 IN MAZE (LAST ITEM AT POINT C), BEFORE

LOT #3 LEAVES POINT A

STAGE NO. 3

LOT #2 ENTERING OPERATING BAY 2 LAST ITEM AT POINT D, BEFORE.

LOT #3 REACHES POINT B

INTER-BAY ITEM TRANSFER

(MAZE CONCEPT)

REVISED	DATE	DESCRIPTION	BY	APPROVED

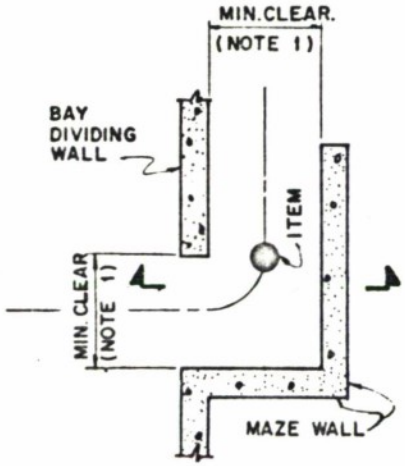
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

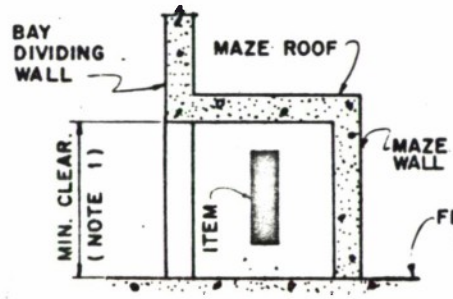
PLATE No. 3.3

TRANSFER OF EXPLOSIVES THROUGH BUILDINGS

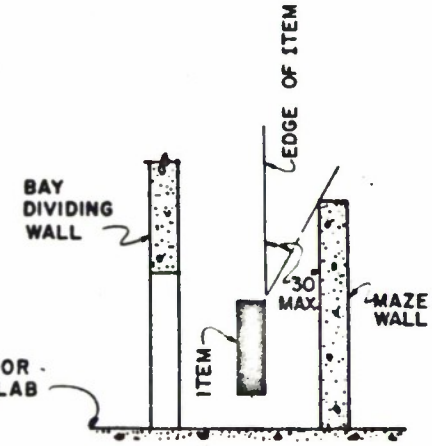
APPROVED K.S. Baker 10-17-72		
DRAWN BY C.N.T.	CHECKED BY K.A.G.	SCALE -
SUBMITTED N. Dobbs	DATE OCT. 16, 72	DWG. NO.



PLAN



SECTION
(MAZE WITH ROOF)



SECTION
(MAZE WITHOUT ROOF)

MAZE DETAILS

NOTES:

1. MINIMUM CLEARANCE BASE ON SEPARATION DISTANCES GIVEN IN PARAGRAPH 4-9 (TM5-1300) OR AS REQUIRED FOR SAFE EQUIPMENT MAINTENANCE.
2. ELEMENTS OF A MAZE SHALL BE DESIGNED TO SUSTAIN DAMAGE EQUAL TO OR LESS THAN THAT OF THE DIVIDING WALL.

REVISIONS	DATE	DESCRIPTION	BY	APPROVAL

PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

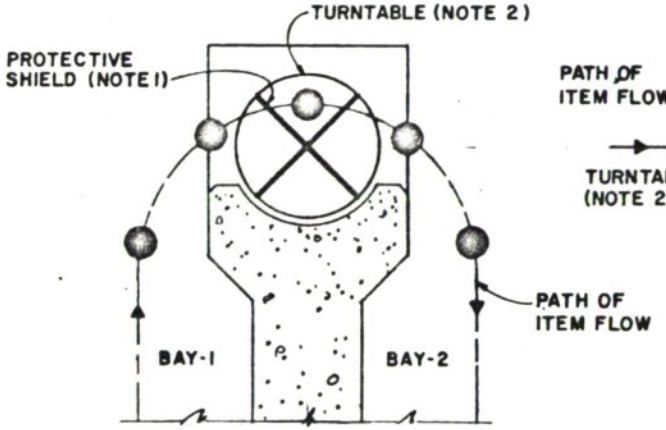
PLATE No. 3.4

TRANSFER OF EXPLOSIVES THROUGH BUILDINGS

APPROVED: P.E. Fraties 10-17-72		
DRAWN BY: C.J.T.	CHECKED BY: K.A.G.	SCALE
SUBMITTED: M. Dobbs	DATE: OCT. 6, 72	DWG. NO.

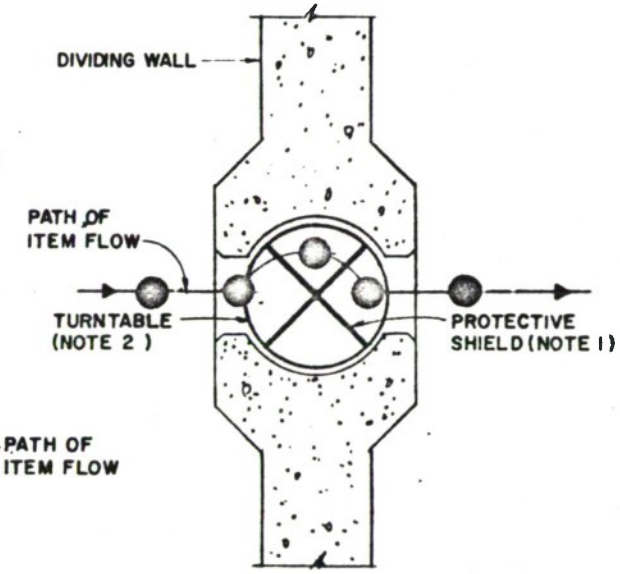
NOTES:

1. SAFE SHIELDING BETWEEN ITEMS TO BE ESTABLISHED BY TESTING.
2. TURNTABLE TO HAVE THE SAME BLAST RESISTANT CAPACITY AS DIVIDING WALL. TURNTABLE TO REMAIN INTACT AND IN PLACE FOR INCIPIENT WALL RESPONSE.



PLAN

TURNTABLE AT END OF DIVIDING WALL



PLAN

TURNTABLE WITHIN DIVIDING WALL

INTER-BAY ITEM TRANSFER
(TURNTABLE CONCEPT)

REVISION	DATE	DESCRIPTION	BY	APPROVAL

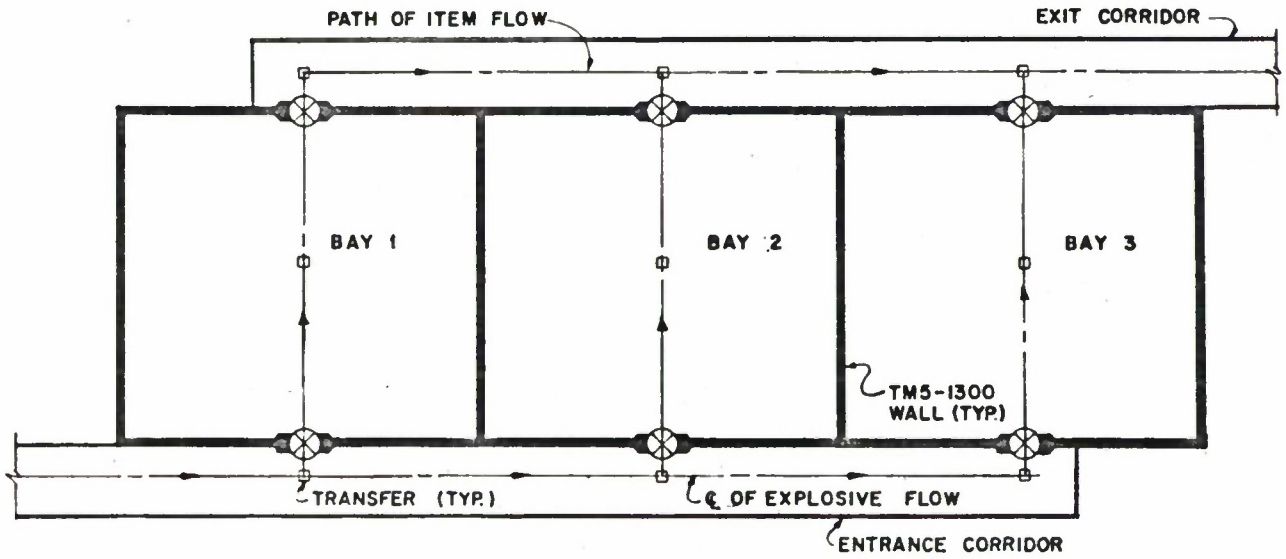
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 3.5

TRANSFER OF EXPLOSIVES THROUGH BUILDINGS

APPROVED [signature] 10-17-72		
DRAWN BY CJT	CHECKED BY KAG	SCALE
SUBMITTED [signature]	DATE OCT 16, 72	DWG. NO.



PASSAGE OF EXPLOSIVES INTO AND IN FRONT OF OPERATING BAYS

(ARRANGEMENT - 1)

REVISION	DATE	DESCRIPTION	BY	APPROVAL

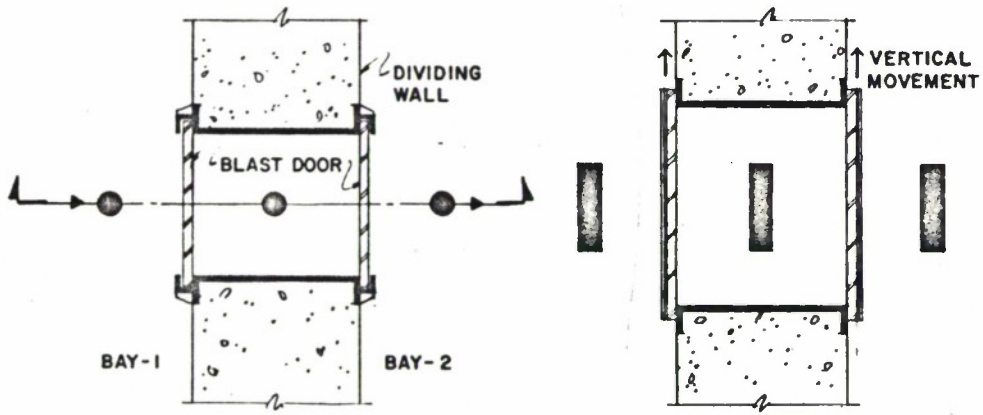
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 3.6

TRANSFER OF EXPLOSIVES THROUGH BUILDINGS

APPROVED K.C. Whitney 10-17-72		
DRAWN BY CNT	CHECKED BY KAG	SCALE
SUBMITTED N Dobbs	DATE Oct 16, 72	DWG NO.



INTER-BAY ITEM TRANSFER
(BLAST LOCK CONCEPT)

NOTES:

1. EACH DOOR SHALL BE DESIGNED TO RESIST THE EFFECTS OF AN EXPLOSION IN EITHER BAY.
2. COORDINATE OPERATION OF DOORS WITH MOVEMENT OF ITEMS.
3. ONE DOOR SHALL BE CLOSED AT ANY GIVEN TIME.

REVISION	DATE	DESCRIPTION	BY	APPROVAL

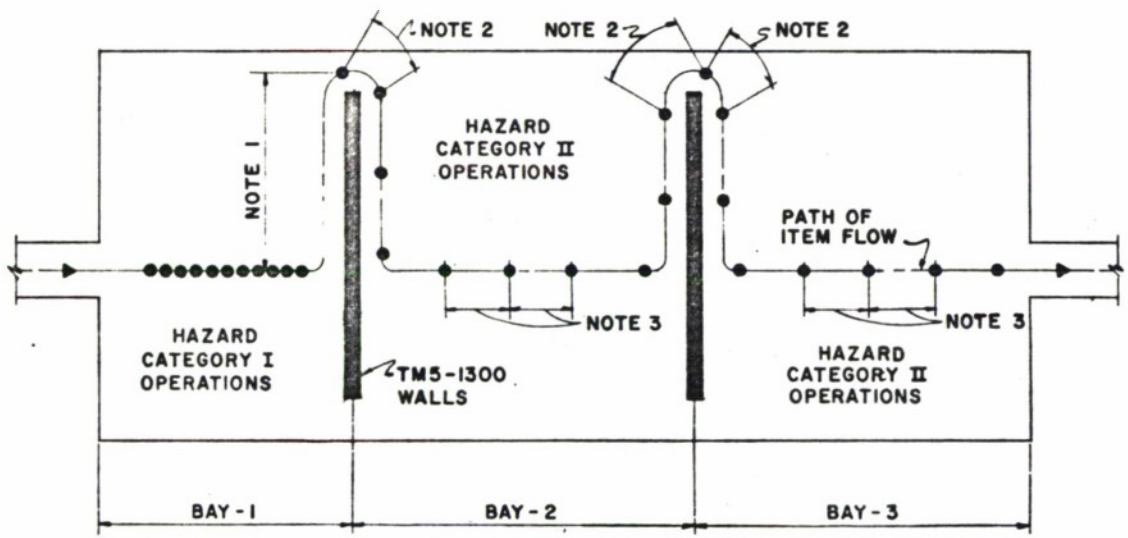
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 3.7

TRANSFER OF EXPLOSIVES THROUGH BUILDINGS

APPROVED		
DRAWN BY C N T	CHECKED BY K A G	SCALE
SUBMITTED	DATE OCT. 16, 72	DWG. NO.



REQUIREMENTS FOR TRANSFER OF EXPLOSIVES AROUND OR OVER DIVIDING WALLS

NOTES:

1. SAFE SPACING AND/OR SHIELDING REQUIRED TO PREVENT PROPAGATION OF EXPLOSION TO BAY-1 DUE TO A MASS DETONATION IN BAY-2.
2. SAFE SPACING AND/OR SHIELDIND REQUIRED TO PREVENT PROPAGATION OF EXPLOSION TO BAY-2 FROM A MASS DETONATION IN BAY-1 OR BAY-3 OR TO BAY-3 FROM A MASS DETONATION IN BAY-2.
3. SAFE SPACING AND/OR SHIELDIND REQUIRED BETWEEN ITEMS FOR CATEGORY II OPERATIONS.

REVISION	DATE	DESCRIPTION	BY	APPROVAL

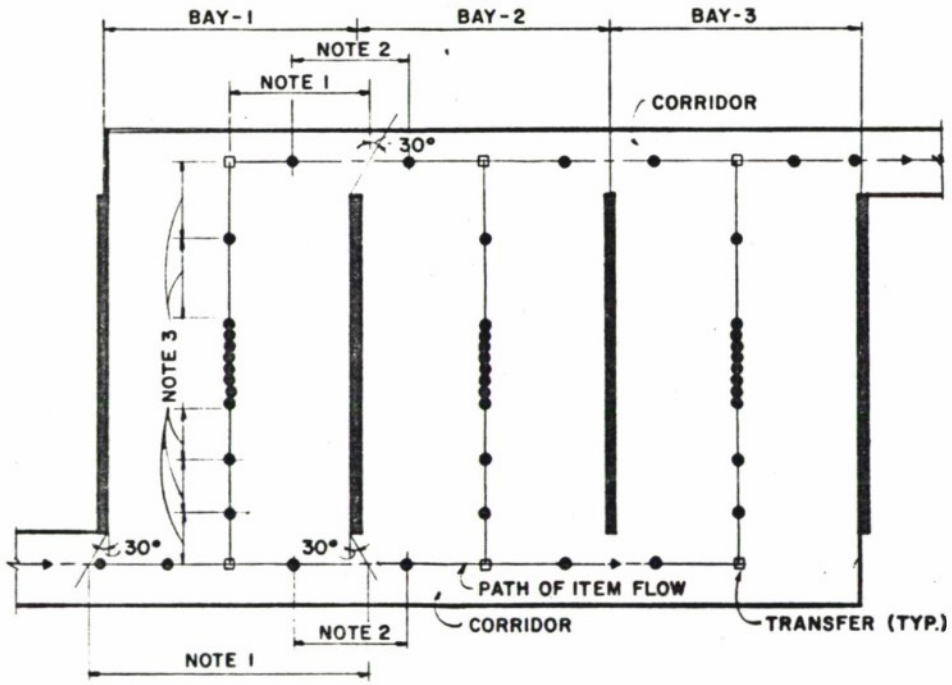
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 3.8

TRANSFER OF EXPLOSIVES THROUGH BUILDINGS

APPROVED: R.E. Fisher 10-17-72		
DRAWN BY: C.N.T.	CHECKED BY: K.A.G.	SCALE
SUBMITTED: M. Dabbs	DATE: OCT 16, 72	DWG. NO.



PASSAGE OF EXPLOSIVES INTO AND IN FRONT OF OPERATING BAYS

(ARRANGEMENT-2)

NOTES:

1. ITEMS IN CORRIDORS TO BE CONSIDERED AS PART OF EXPLOSIVE QUANTITY ALLOWANCE OF BAY-1.
2. SAFE SPACING OR SHIELDING BETWEEN ITEMS REQUIRED TO PREVENT PROPAGATION OF EXPLOSION TO BAY-2 DUE TO A MASS DETONATION IN BAY-1.
3. SAFE SPACING OR SHIELDING BETWEEN ITEMS REQUIRED TO PREVENT PROPAGATION OF EXPLOSION FROM THE CORRIDORS INTO THE OPERATING BAYS.
4. NOTES APPLICABLE TO BAY-1 ARE ALSO APPLICABLE TO BAYS 2 & 3.

REVISION	DATE	DESCRIPTION	BY	APPROVAL

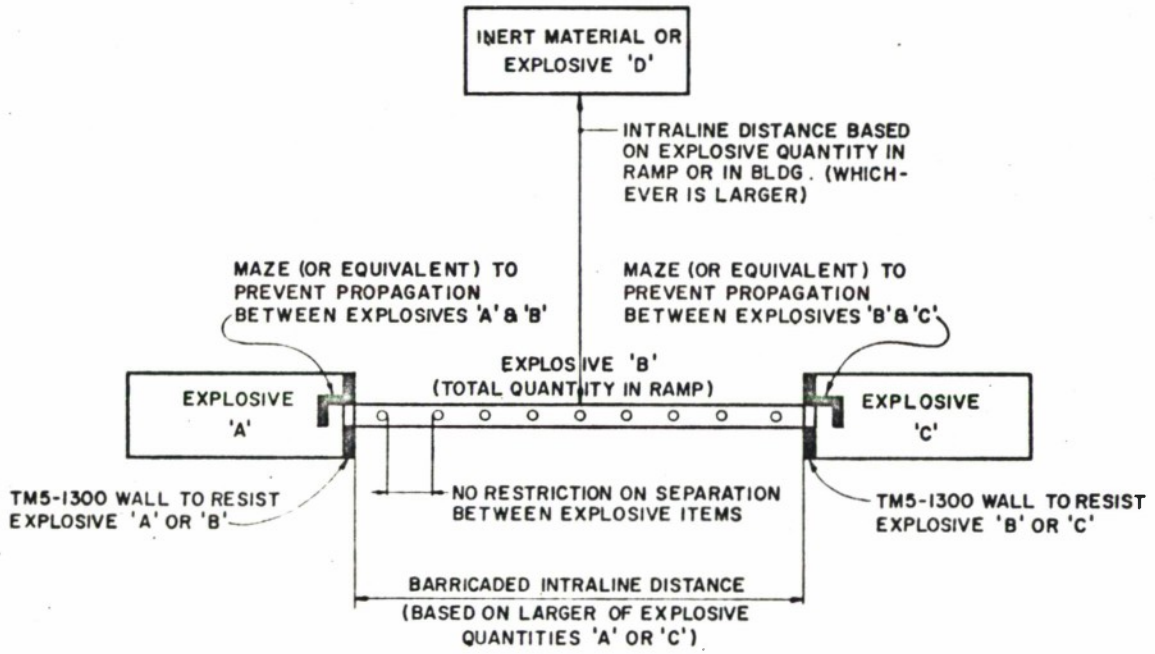
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 3.9

TRANSFER OF EXPLOSIVES THROUGH BUILDINGS

APPROVED		10-17-72
DRAWN BY: CNT	CHECKED BY: MAG	SCALE
SUBMITTED: M Dobbs	DATE: OCT. 16, 72	DWG. NO.



TRANSFER ARRANGEMENT NO. 1

REVISION	DATE	DESCRIPTION	BY	APPROVAL

PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

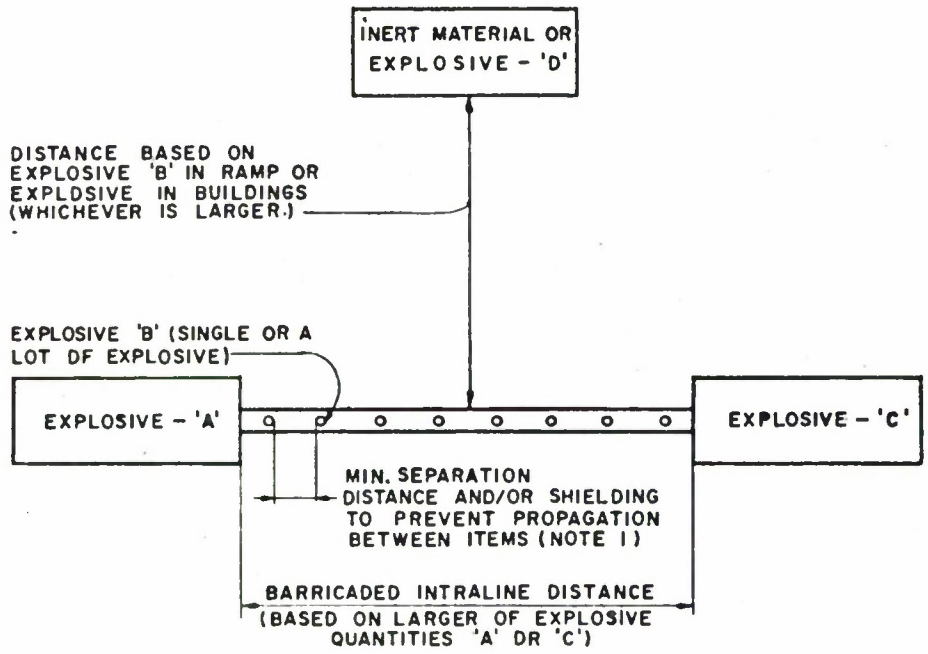
PLATE No. 4.1

TRANSFER OF EXPLOSIVES BETWEEN BUILDINGS

APPROVED		10-17-72
DRAWN BY CNT	CHECKED BY KAG	SCALE -
SUBMITTED	DATE OCT 16, 72	DWG. NO.

NOTES:

1. MINIMUM SEPARATION DISTANCE AND/OR SHIELDING TO PREVENT PROPAGATION SHALL BE ESTABLISHED BY TESTING.



TRANSFER ARRANGEMENT No. 2

REVISION	DATE	DESCRIPTION	BY	APPROVAL

PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

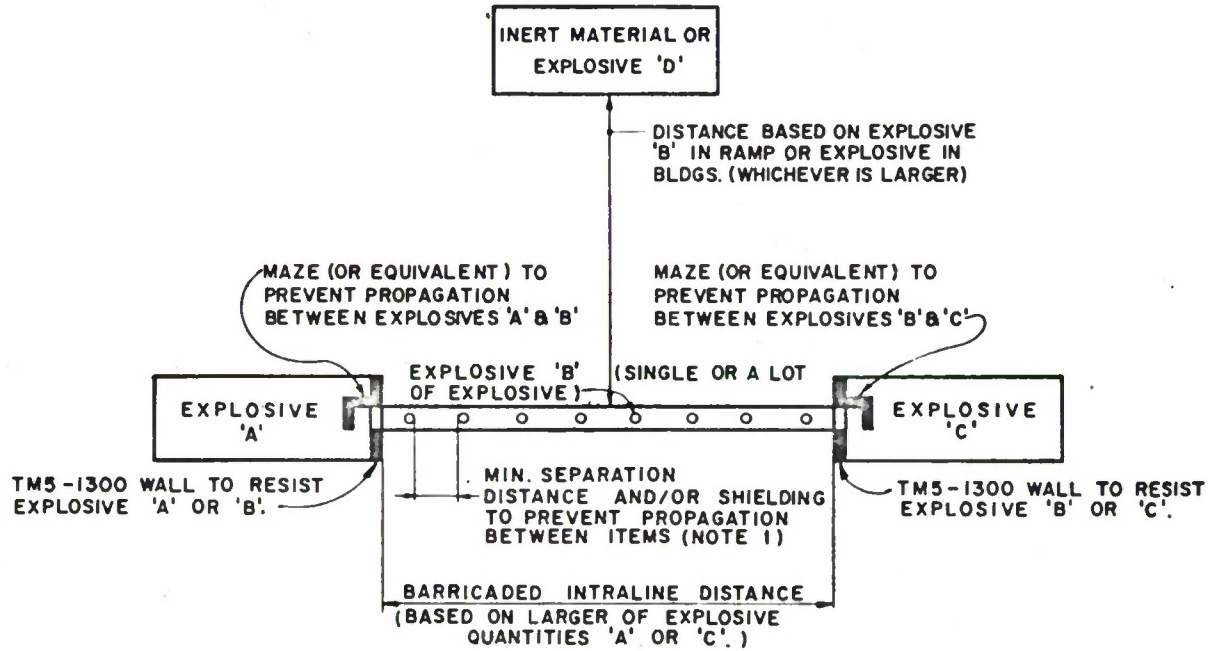
PLATE No. 4.2

TRANSFER OF EXPLOSIVES BETWEEN BUILDINGS

APPROVED		
DRAWN BY C N T	CHECKED BY HAG	SCALE
SUBMITTED	DATE OCT. 16 72	DWG NO.

NOTES:

1. MINIMUM SEPARATION DISTANCE AND/OR SHIELDING TO PREVENT PROPAGATION SHALL BE ESTABLISHED BY TESTING.



TRANSFER ARRANGEMENT No. 3

REVISION	DATE	DESCRIPTION	BY	APPROVAL

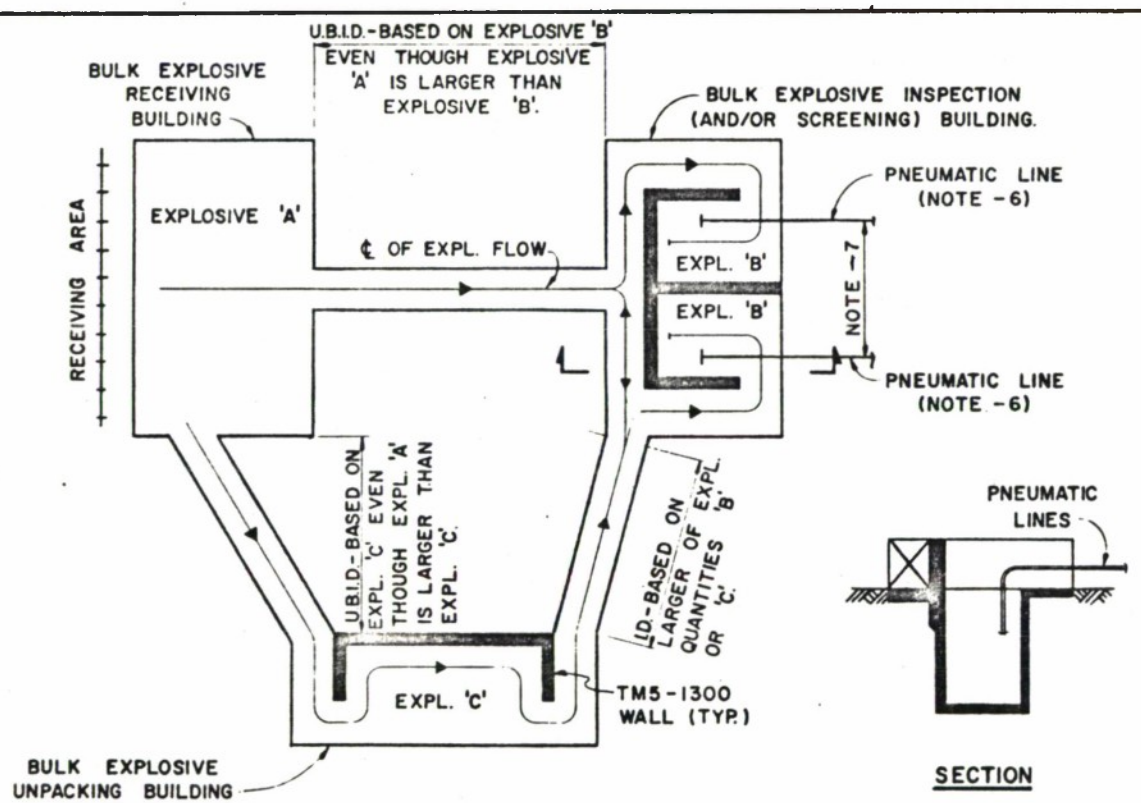
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 4.3

TRANSFER OF EXPLOSIVES BETWEEN BUILDINGS

APPROVED: R. Fischer 10-17-72		
DRAWN BY: C N T	CHECKED BY: K A G	SCALE
SUBMITTED: N. Dobbs	DATE: OCT. 16, 72	DWG. NO.



NOTES:

1. A MAXIMUM OF TWO BAYS SHALL BE PROVIDED IN ANY ONE INSPECTION BUILDING WITH EACH BAY HAVING AN INDEPENDENT ACCESS.
2. INSPECTION AND UNPACKING BUILDINGS SHALL BE BARRICADED FROM RECEIVING BUILDING.
3. IF POSSIBLE POSITION RECEIVING BLDG BETWEEN RECEIVING PLATFORMS AND SCREENING BUILDING.
4. EXCEPT FOR TRANSFERRING OF TOTE BINS, ALL OPERATIONS IN SCREENING BUILDING SHALL BE PERFORMED REMOTELY.
5. CARDBOARD BOXES FOR SHIPPING EXPLOSIVES MAY BE OPENED IN RECEIVING BUILDING BUT INNER PLASTIC WRAPPINGS SHALL BE OPENED REMOTELY IN INSPECTION BAY; OR MANUALLY IN UNPACKING BUILDING OR IN A SEPARATE BAY IN THE INSPECTION BUILDING.
6. DETONATION TRAPS OR OTHER MEANS SHALL BE PROVIDED TO PREVENT PROPAGATION OF EXPLOSIONS IN PNEUMATIC LINES.
7. SAFE SPACING AND/OR SHIELDING SHALL BE PROVIDED TO PREVENT PROPAGATION OF EXPLOSION BETWEEN PNEUMATIC LINES.

REVISION	DATE	DESCRIPTION	BY	APPROVAL
1	8/72			ND

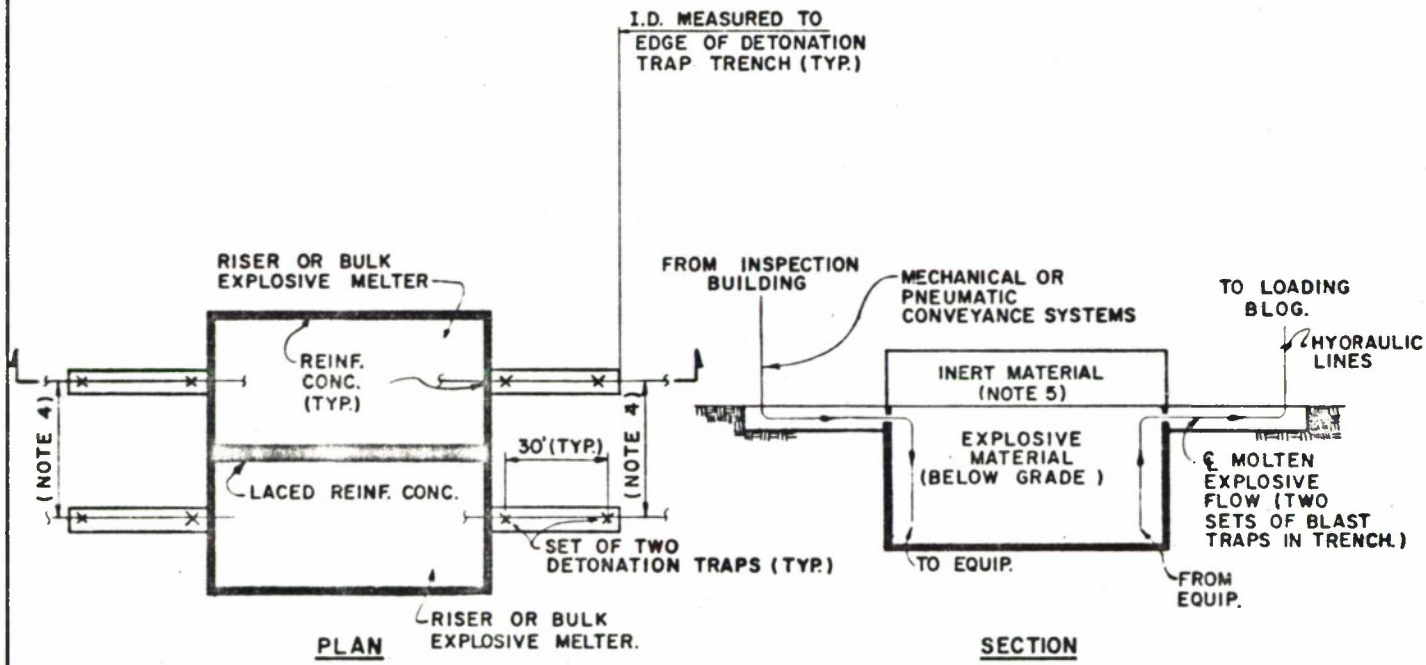
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 5.1

SAFETY CONCEPTS FOR LAP INSTALLATIONS

APPROVED		
DRAWN BY: CNT	CHECKED BY: KAG	SCALE
SUBMITTED: N. Dobbs	DATE: OCT. 16, 72	DWG. NO.



MELTER BUILDING

NOTES:

1. NO MORE THAN 50% OF EXPLOSIVE MELTING CAPABILITY TO BE LOCATED IN ANY ONE MELTER BUILDING.
2. BOTH BULK & RISER MELTING FACILITIES MAY BE LOCATED IN ANY ONE MELT BUILDING IF SEPARATE BAYS ARE PROVIDED FOR EACH MELTING OPERATION.
3. PROVIDE DETONATION TRAPS OR OTHER MEANS TO PREVENT PROPAGATION IN BOTH HYDRAULIC & PNEUMATIC LINES.
4. PROVIDE SAFE SPACING AND/OR SHIELDING TO PREVENT PROPAGATION OF EXPLOSION BETWEEN PNEUMATIC AND HYDRAULIC LINES OR CONVEYERS.
5. VALUABLE EQUIPMENT NOT PERMITTED IN UNBARRICADED ABOVE GROUND PORTION OF STRUCTURE.

REVISION	DATE	DESCRIPTION	BY	APPROVAL

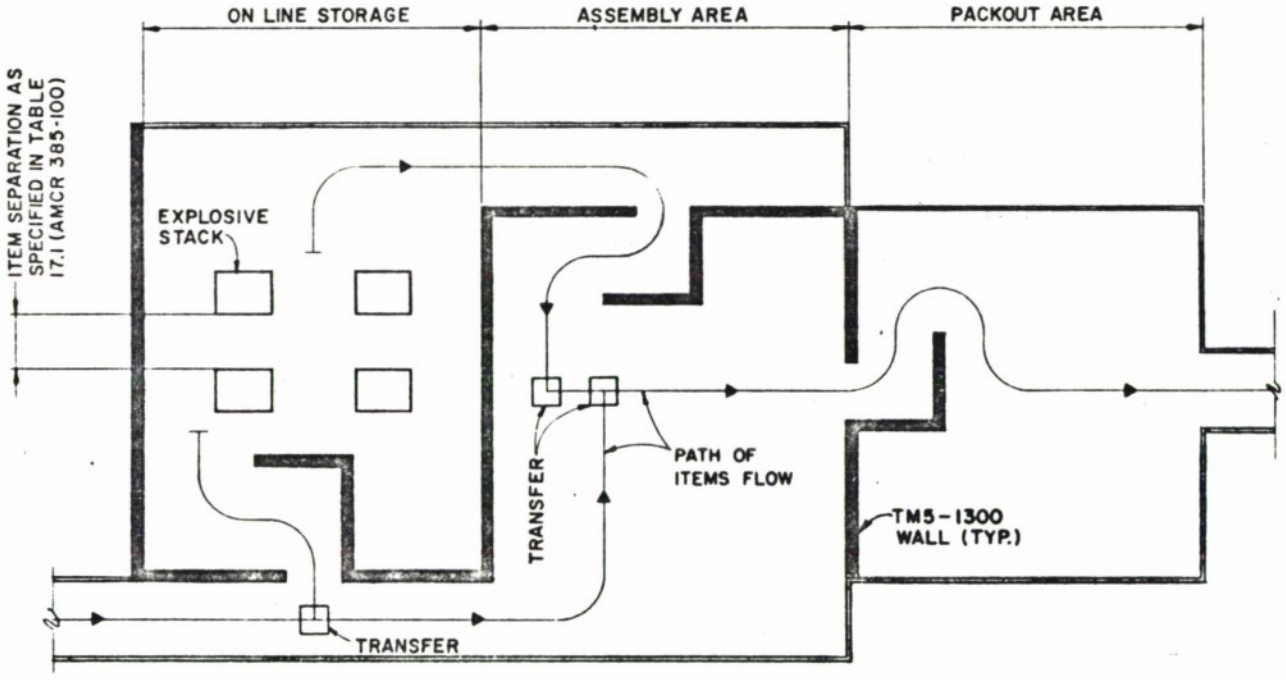
PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 5.2

SAFETY CONCEPTS FOR LAP INSTALLATIONS

APPROVED		
DRAWN BY: C N T	CHECKED BY: K A G	SCALE
SUBMITTED: H Dobbs	DATE: OCT 16-72	DWG. NO.



COMBINED ON-LINE STORAGE, ASSEMBLY & PACKOUT

NOTES:

1. STORAGE, ASSEMBLY AND PACKOUT AREAS SHALL BE SEPARATED FROM ONE ANOTHER BY EFFECTIVE DIVIDING WALL.
2. EXPLOSIVE QUANTITY IN STORAGE AREA FOR DESIGN OF DIVIDING WALLS AND SEPARATION DISTANCES TO BE BASED UPON QUANTITY IN LARGEST STACK WHERE SAFE SEPARATION BETWEEN STACKS SHALL CONFORM TO TABLE 17.1 (AMCR 385-100).

REVISION	DATE	DESCRIPTION	BY	APPROVAL
1	1/3/72			NO

PICATINNY ARSENAL
DOVER, NEW JERSEY

PREPARED BY
AMMANN & WHITNEY, CONSULT. ENG.
111 EIGHTH AVE. NEW YORK, N.Y.

PLATE No. 5.3

SAFETY CONCEPTS FOR LAP INSTALLATIONS

APPROVED		
DRAWN BY C N T	CHECKED BY KAG	SCALE
SUBMITTED	DATE OCT 16, 72	DWG. NO.

TABLE OF DISTRIBUTION

TABLE OF DISTRIBUTION

		Number of Copies
1.	Commander U. S. Army Munitions Command Dover, New Jersey 07801 ATTN: AMSMU-SF	240
2.	Commander Picatinny Arsenal Dover, New Jersey 07801 ATTN: SMUPA-AD SMUPA-TS-T SMUPA-MT-F	 1 1 5
3.	Chairman Department of Defense Explosives Safety Board Forrestal Building Washington, D.C. 20301 ATTN: R. G. Perkins	2
4.	Commander Naval Ordnance Systems Command Department of the Navy Washington, D.C. 20360 ATTN: ORD-048	1
5.	Commander Headquarters, U. S. Air Force Washington, D.C. 20330 ATTN: AFIIS	1
6.	Chief of Engineers Department of the Army Washington, D.C. 20314 ATTN: DAEN-ZA	1

TABLE OF DISTRIBUTION (CONTINUED)

		Number of Copies
7.	OCE Publications Depot 890 South Pickett Street Alexandria, Virginia 22304 ATTN: DAEN-ASP-D	1
8.	Commander U. S. Army Engineering Division, Huntsville P. O. Box 1600 West Station Huntsville, Alabama 35807 ATTN: HND	1
9.	Commander U. S. Army Engineering Division, Lower Mississippi Valley P. O. Box 80 Vicksburg, Mississippi 39180 ATTN: LMV	1
10.	Commander U. S. Army Engineering District, New Orleans P. O. Box 60267 New Orleans, Louisiana 70160 ATTN: LMN	1
11.	Commander U. S. Army Engineering District, St. Louis 210 North 12th Street St. Louis, Missouri 63101 ATTN: LMS	1

TABLE OF DISTRIBUTION (CONTINUED)

		Number of Copies
12.	Commander U. S. Army Engineering District, Vicksburg P. O. Box 60 Vicksburg, Mississippi 39180 ATTN: LMK	1
13.	Commander U. S. Army Engineering Division, Missouri River P. O. Box 103 Downtown Station Omaha, Nebraska 68101 ATTN: MRD	1
14.	Commander U. S. Army Engineering District, Kansas City 700 Federal Building 601 E. 12th Street Kansas City, Missouri 64106 ATTN: MRK	1
15.	Commander U. S. Army Engineering District, Omaha 7410 USPO & Courthouse 215 North 17th Street Omaha, Nebraska 68102 ATTN: MRO	1
16.	Commander U. S. Army Engineering Division, New England 424 Trapelo Road Waltham, Massachusetts 02154 ATTN: NED	1

TABLE OF DISTRIBUTION (CONTINUED)

		Number of Copies
17.	Commander U. S. Army Engineering Division, North Atlantic 90 Church Street New York, New York 10007 ATTN: NAD	1
18.	Commander U. S. Army Engineering District, Baltimore P. O. Box 1715 Baltimore, Maryland 21203 ATTN: NAB	1
19.	Commander U. S. Army Engineering District, New York 26 Federal Plaza New York, New York 10007 ATTN: NAN	1
20.	Commander U. S. Army Engineering District, Norfolk 803 Front Street Norfolk, Virginia 23510 ATTN: NAO	1
21.	Commander U. S. Army Engineering District, Philadelphia U. S. Custom House 2nd & Chestnut Street Philadelphia, Pennsylvania 19106 ATTN: NAP	1

TABLE OF DISTRIBUTION (CONTINUED)

		Number of Copies
22.	Commander U. S. Army Engineering District, Susquehanna P. O. Box 2679 Harrisburg, Pennsylvania 17105 ATTN: NAS	1
23.	Commander U. S. Army Engineering Division, North Central 536 S. Clark Street Chicago, Illinois 60605 ATTN: NCD	1
24.	Commander U. S. Army Engineering District, Buffalo 1776 Niagara Street Buffalo, New York 14207 ATTN: NCB	1
25.	Commander U. S. Army Engineering District, Chicago 219 S. Dearborn Street Chicago, Illinois 60604 ATTN: NCC	1
26.	Commander U. S. Army Engineering District, Detroit P. O. Box 1027 Detroit, Michigan 48231 ATTN: NCE	1

TABLE OF DISTRIBUTION (CONTINUED)

		Number of Copies
27.	Commander U. S. Army Engineering District, Rock Island Clock Tower Building Rock Island, Illinois 61201 ATTN: NCR	1
28.	Commander U. S. Army Engineering District, St. Paul 1210 USPO & Custom House St. Paul, Minnesota 55101 ATTN: NCS	1
29.	Commander U. S. Army Engineering Division, North Pacific Room 210, Custom House Portland, Oregon 97209 ATTN: NPD	1
30.	Commander U. S. Army Engineering District, Alaska P. O. Box 7002 Anchorage, Alaska 99510 ATTN: NPA	1
31.	Commander U. S. Army Engineering District, Portland P. O. Box 2946 Portland, Oregon 97208 ATTN: NPP	1

TABLE OF DISTRIBUTION (CONTINUED)

		Number of Copies
32.	Commander U. S. Army Engineering District, Seattle 1519 Alaskan Way South Seattle, Washington 98134 ATTN: NPS	1
33.	Commander U. S. Army Engineering District, Walla Walla Building 602, City-County Airport Walla Walla, Washington 99362 ATTN: NPW	1
34.	Commander U. S. Army Engineering Division, Ohio River P. O. Box 1159 Cincinnati, Ohio 45201 ATTN: ORD	1
35.	Commander U. S. Army Engineering District, Huntington P. O. Box 2127 Huntington, W. Virginia 25721 ATTN: ORH	1
36.	Commander U. S. Army Engineering District, Louisville P. O. Box 59 Louisville, Kentucky 40201 ATTN: ORL	1

TABLE OF DISTRIBUTION (CONTINUED)

		Number of Copies
37.	Commander U. S. Army Engineering District, Nashville P. O. Box 1070 Nashville, Tennessee 37202 ATTN: ORN	1
38.	Commander U. S. Army Engineering District, Pittsburgh Federal Building 1000 Liberty Avenue Pittsburgh, Pennsylvania 15222 ATTN: ORP	1
39.	Commander U. S. Army Engineering Division, South Atlantic 510 Title Building 30 Pryor Street, S.W. Atlanta, Georgia 30303 ATTN: SAD	1
40.	Commander U. S. Army Engineering District, Charleston P. O. Box 919 Charleston, South Carolina 29402 ATTN: SAN	1

TABLE OF DISTRIBUTION (CONTINUED)

		Number of Copies
41.	Commander U. S. Army Engineering District, Jacksonville P. O. Box 4970 Jacksonville, Florida 32201 ATTN: SAJ	1
42.	Commander U. S. Army Engineering District, Mobile P. O. Box 2288 Mobile, Alabama 36628 ATTN: SAM	1
43.	Commander U. S. Army Engineering District, Savannah P. O. Box 889 Savannah, Georgia 31402 ATTN: SAS	1
44.	Commander U. S. Army Engineering District, Wilmington P. O. Box 1890 Wilmington, North Carolina 28401 ATTN: SAW	1
45.	Commander U. S. Army Engineering Division, South Pacific 630 Sansome Street, Room 1216 San Francisco, California 94111 ATTN: SPD	1

TABLE OF DISTRIBUTION (CONTINUED)

Number of Copies

46. Commander
U. S. Army Engineering District,
Los Angeles
P. O. Box 2711
Los Angeles, California 90053
ATTN: SPL — 1

47. Commander
U. S. Army Engineering District,
Sacramento
650 Capitol Mall
Sacramento, California 95814
ATTN: SPK — 1

48. Commander
U. S. Army Engineering District,
San Francisco
100 McAllister Street
San Francisco, California 94102
ATTN: SPN — 1

49. Commander
U. S. Army Engineering Division,
Southwestern
1114 Commerce Street
Dallas, Texas 75202
ATTN: SWD — 1

TABLE OF DISTRIBUTION (CONTINUED)

		Number of Copies
50.	Commander U. S. Army Engineering District, Albuquerque P. O. Box 1580 Albuquerque, New Mexico 87103 ATTN: SWA	1
51.	Commander U. S. Army Engineering District, Fort Worth P. O. Box 17300 Fort Worth, Texas 76102 ATTN: SWF	1
52.	Commander U. S. Army Engineering District, Galveston P. O. Box 1229 Galveston, Texas 77550 ATTN: SWG	1
53.	Commander U. S. Army Engineering District, Little Rock P. O. Box 867 Little Rock, Arkansas 72203 ATTN: SWL	1
54.	Commander U. S. Army Engineering District, Tulsa P. O. Box 61 Tulsa, Oklahoma 74102 ATTN: SWT	1